MODERN PLASTICS

NOVEMBER 1950

It pays to use your custom molder's know-how

for ideas that save costs, improve performance

No. 23 in a Series on Plastics Skill at Work...

PROJECT:
Transformer switch frame

MOLDER:
McDonald Manufacturing Co.

MATERIAL:
Durez electrical insulating phenolic plastic

TRANSFORMER SWITCH FRAME for operation in oil. End and side views show how custom molder used loose coring to eliminate machining operations. Durez formulation used here has excellent arc-resisting qualities. Custom molder's skill determined pre-heating rate that increased dielectric properties of the material.

Thin walls as well as thick sections withstand required voltage without breakdown.

● Helping manufacturers in diverse fields to get the greatest benefit from plastics, your custom molders pile up a fund of useful experience that is available for whatever project you may have.

Thoroughly familiar with developments in Durez phenolics, they can advise on the choice of the Durez material that will give you the best results at the lowest cost. They can also, as in this example, determine pre-heating temperatures, mold design and other factors that influence the economy and performance of your product.

Here, choice of the proper molding method speeded up output by 50%. Pre-heating at the optimum temperature further shortened the molding cycle. In test, this also was found to enhance the inherent dielectric properties of the material by improving its density. Use of loose coring eliminated costly machining and took full advantage of the natural lustrous finish you get in molded Durez.

Working closely with custom molders, our staff of Durez technicians brings you our specialized experience in the great phenolics group. Let them help you use most successfully the broad scale of mechanical, chemical, and electrical properties of Durez in your product development work.

A bit with plastics users everywhere is the handy "Durez Check-Chart." Write for yours. Durez Plastics & Chemicals, Inc., 1211 Walck Rd., N. Tonawanda, N. Y.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

PHENOLIC PLASTICS THAT FIT THE JOB

THREE *Catalin* PLASTICS IN THE SERVICE OF American Safety Razor Corp. PRODUCTS

1. *Catalin* CAST PHENOLIC

Its incomparable sales-appealing beauty is being cast from inexpensive molds and fabricated into handsome Ever-Ready® shaving brush handles and brush stands that are unaffected by hot water, soaps or lotions.

2. *Catalin* BRISTLE-SETTING RESIN

This special water-proof and soap-impervious liquid resin permanently bonds the bristles to the handle. Other *Catalin* urea, phenol and resorcinol liquid resin formulations are available for laminating, bonding, glueing and finishing wood, fabrics, abrasives, paper, cork, etc.

3. *Catalin* STYRENE

Chosen as the most economical and physically ideal injection molding compound for the new fast-action dispensers for GEM® single edge razor blades and Silver Star® double edge razor blades.

By the good they do and thru the impressive company they keep, Catalin Plastics are held in highest regard by America's leading manufacturers. The Catalin technical staff invites the opportunity to counsel with you in selecting the correct Catalin plastic or resin for your particular requirements!

CATALIN CORPORATION OF AMERICA

ONE PARK AVENUE, NEW YORK 16, N. Y.

® American Safety Razor Corp.

MODERN PLASTICS*

VOLUME 28 NOVEMBER 1950 NUMBER 3

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*Reg. U. S. Pat. Office

Another new development using

B. F. Goodrich Chemical Company ***raw materials***

what the well-dressed man wears

—WHERE DANGEROUS CHEMICALS ABOUND

"Gra-Lite" clothing made by Standard Safety Equipment Company, Chicago, Ill. B. F. Goodrich Chemical Company does not make this clothing. We supply some materials for the coating only.

ANY man who works around dangerous chemicals will tell you how necessary safety clothing is. Especially important is the length of time it *resists* chemicals. For if red fuming nitric acid should touch the clothing, a matter of extra minutes of resistance makes the difference between safety and serious, or fatal injury.

The Geon resin coated clothing pictured gives workmen that all-important time-margin of safety. The Geon coating not only gives high chemical resistance, but also an increased period of resistance.

That's just the start of the Geon coating's advantages. It has excellent abrasion resistance. It's light in weight. A suit of overalls like the one pictured weighs only 27 ounces. Geon's color-adaptability is another big help. It can be compounded in light colors—the pearl gray used here providing improved reflection of sunlight, increasing comfort to the wearer.

There's added safety in Geon's flame-resistance. And the coating's flexibility at low temperature is important for outdoor winter work.

Geon materials have many advantages that help improve products—improve their sales, too. Products of Geon can be made resistant to heat and cold, weather and wear—to water, grease, oil, oxidation and many chemicals. Colors can be brilliant or delicate. We'll gladly give you helpful advice on the many uses and applications for Geon. For technical bulletins, please write Dept. GA-11, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco.

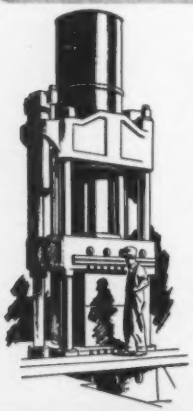
Geon
Polyvinyl Materials

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, [illegible] and more economically

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plast[illegible]

CHICAGO MOLDED PRODUCTS CORPORATION

...makes 'em bigger and better for Motorola



The new Motorola Model 17T3 Television Receiver is no baby. Its handsome cabinet measures 17¾" x 19½" x 18$^{15}/_{16}$" and with its strong, heavy wall sections it all adds up to 22 lbs. of molded plastics.

The huge presses that produce these cabinets are not babies, either. They're modern giants... efficient... fast acting ...delivering 1200 tons pressure for speedy, economical production. And we have others even larger.

This is just another example of our ability to handle any molded plastics job ... simple or complex... no matter how large. In our injection molding department we are equally well equipped with batteries of presses in sizes up to 64 oz. capacity. And all this is backed by more than 30 years of experience in plastics.

That's why Motorola and hundreds of other leaders consider Chicago Molded a primary source of supply for the best in molded plastics. And we think you'll find this a good reason for discussing your next job with a Chicago Molded engineer. Just write or phone.

CHICAGO MOLDED PRODUCTS CORPORATION
1046 N. KOLMAR AVENUE, CHICAGO 51, ILLINOIS

COMPRESSION, INJECTION AND PLUNGER MOLDING OF ALL PLASTIC MATERIALS

EDITORIAL

Your Business Future is at Stake

There is no official connection between the organization that publishes MODERN PLASTICS Magazine and the Society of the Plastics Industry, Inc. Therefore, this magazine has no specific obligation to promote increased membership in S.P.I.

But. . .

We think it is about time that many companies engaged wholly or partly in the production of plastics products and plastics components became acquainted with business procedure in a mobilization economy and hastened to take out memberships in S.P.I.

For instance, there are only about 350 injection molder members in S.P.I.; there must be well over 1300 companies in the business who are not members. Which, of course, makes it impossible for S.P.I. to do an adequate job of representing this segment of the industry in Washington.

One basic fact in a mobilization economy is that a vertical interest in any industry must have special representation before the allocation and procurement authorities in the National Capital in order to have its rights recognized.

Government machinery for allocations, price controls, and similar devices for smoothing mobilization of resources will be imposed gradually, the rate depending on the trend of international affairs and the trend of inflation on the home front. In the establishment of priorities it is inevitable that government will consult with recognized representation of industry by groups to get the facts on which to base decisions.

S.P.I. will certainly be called upon by government to represent the plastics industry. Whether the injection molders are members or not, they are bound to be thus represented. But S.P.I. will be able to serve them properly only if it has their full support and the benefit of their collective thinking.

Injection molding has become big business. It is about time it talked like big business. It is about time injection molders spoke with one voice at Washington, spoke firmly, spoke consistently. And it appears to us that membership in S.P.I., with S.P.I. given the authority to speak for the injection molders, is the only practical way to gain that voice.

The mobilization program is a long-term project which is going to involve constantly increased pressure for materials from all sides. Furthermore, it contributes to a boom economy. When the quantities of each material specifically required for military use have been set aside, that which remains will be divided among industrial users. And how will that division of materials be determined? Very simply. By adequate and unified representation at Washington for each group of users. The men in charge of the program are not omniscient; they can be completely fair only if the full facts are brought to their attention.

No single company can adequately represent itself in Washington, particularly in a period of mobilization. So we say, especially to the injection molders, but also to all others in the industry whose corporate future is at stake in this period of material pressure: Join the Society of the Plastics Industry today and protect your business interests in Washington.

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A NEW Insulating Laminate...

INSUROK* GRADE T-812

COMBINES:

- SUPERLATIVE INSULATION RESISTANCE
- LOW MOISTURE ABSORPTION
- VERY HIGH STRENGTH
- EXCELLENT PUNCHABILITY

*Reg. U. S. Pat. Off.

INSUROK T-812 is a new paper-base punching stock that laughs at heat and humidity! It has outstanding properties that have never before been combined in one insulating laminate. T-812 has excellent electrical characteristics, plus a spectacular ability to retain them through extremes of heat and humidity. Its insulation resistance after humidity conditioning is particularly noteworthy.

INSUROK T-812 retains all of the properties of the well-known INSUROK T-725 and, in addition, has lower moisture absorption and much higher insulation resistance. It punches readily into intricate shapes. Investigate INSUROK T-812 for your product. Information upon request.

T-812's *Property Combination* —Unmatched by any other material!

Thickness tested.....1/16"
Moisture Absorption (24 hours).....0.39%
Expansion after 24 hours' immersion in water at 77°F. Center....0.0001" Edge.....0.0002"
Tensile Strength, psi.....Main Direction.....19,500.....Cross Direction.....14,500
Flexural Strength, psi.....Main Direction.....23,000.....Cross Direction.....18,000
Dielectric Strength (perpendicular to laminations) V/Mil, Short Time.....725 Step by Step.....625

	Tests at Room Conditions	After 96 hrs. at 90% Rel. Hum. at 104°F.
Power Factor at 1 megacycle	0.028	0.030
Dielectric Constant at 1 megacycle	4.4	4.5
Loss Factor at 1 megacycle	0.13	0.14
Insulation Resistance, megohms		1,000,000

The RICHARDSON COMPANY

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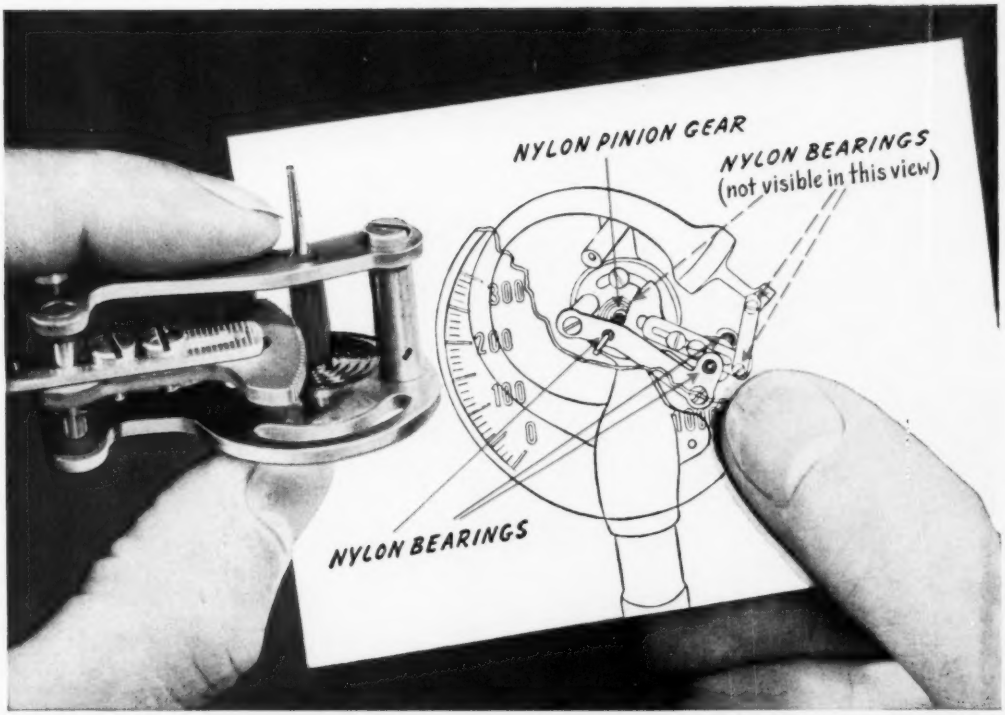
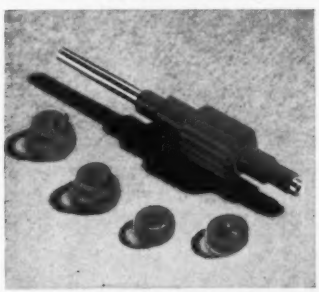


NYLON PLASTIC GEARS AND BEARINGS

ABSORB SHOCK...RESIST WEAR...GIVE LONG LIFE

Severe vibrating and pulsating will wear down the mechanism of an ordinary pressure gauge . . . cause it to register inaccurately. To produce a gauge that would operate with utmost efficiency over extended periods,



NYLON PINION is machined from blank injection-molded directly onto metal shaft by Plastic Mfrs. Corp., Stamford, Conn. Nylon bearings are machined from rod stock supplied by the Polymer Corp., Reading, Pa. Accuracy of the gauge is guaranteed by its manufacturer to within one half of one per cent of dial graduation over entire scale of a full 270° dial arc.

Manning, Maxwell and Moore developed a "nylon movement" for their Ashcroft "Duragauge." Five years of extensive field testing prove that the nylon movement outperforms and outlasts other gauge movements under severe conditions of vibration, pulsation and fretting corrosion.

Nylon parts offer an extremely low coefficient of friction. Too, nylon is highly resilient . . . resists abrasion. It absorbs vibrations without passing them along. Under shock loading, nylon's "plastic memory" allows parts to return to original size . . . maintains accuracy.

A large chemical company installed one of these gauges on "the worst pulsating service to be found." After 10 months of continuous use, the gauge was removed. Under microscopic examination, the nylon movement showed no visible wear!

Durable nylon plastic is finding more and more uses in gears, bearings, and machine parts for textile machinery, business machines, movie cameras, electric shavers, household appliances, and many other types of equipment. Its properties may well help you, too. For literature on nylon and other Du Pont plastics, write today:
E. I. du Pont de Nemours & Co. (Inc.) Polychemicals Dept., Sales Offices: 350 Fifth Avenue, New York 1, N. Y.; 7 S. Dearborn St., Chicago 3, Ill.; 845 E. 60th Street, Los Angeles 1, Calif.

DU PONT
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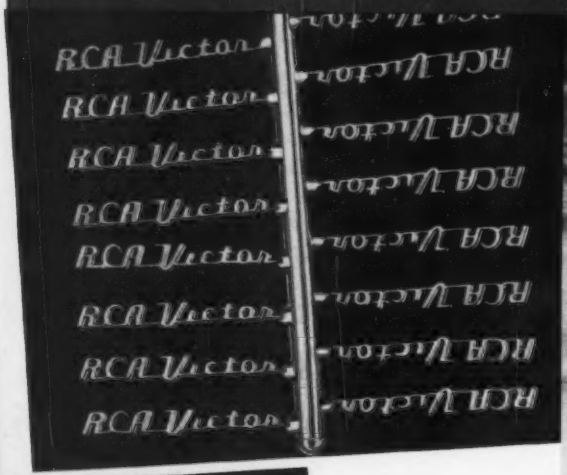
PLASTICS
Better Things for Better Living
. . . through Chemistry

Save WITH PLASTIC NAME PLATES by Santay

PLASTICS are now replacing metals for name plates on appliances. Big names in Radio and Television are specifying on the smallest to the largest and finest cabinets with logotypes made from Injection Molded Thermoplastics by SANTAY. *Big savings* are effected as compared with name plates made of metal.

The RCA VICTOR and DECCA logos pictured here are produced with speed and efficiency in 16 cavity molds on 2 ounce equipment. An 8 cavity mold is used for the ADMIRAL job. Santay can supply Plastic Logotypes 1. Gold Plated, 2. Silver Plated, 3. plain painted, or 4. plain molded in any desired color. Logotypes are smooth, clean, and beautifully finished. They enhance the beauty of even the costliest cabinets.

IF YOU use logotypes or name plates on *your* products, by all means get the *big savings* made possible by precision SANTAY injection moldings. Without obligation, ask for samples and low cost estimates. Write or phone us or our nearest field man today.



Here, awaiting your instructions, are equipment and craftsmen seasoned by more than 30 years of pioneering and specialization in designing, tooling, molding and finishing Thermoplastics. All operations are completed with speed and efficiency under one roof! You, too, will gain profit and prestige by making use of these unusual facilities.

ILLUSTRATING LUGS BY WHICH SANTAY LOGOTYPES ARE FASTENED TO CABINETS

SANTAY CORPORATION

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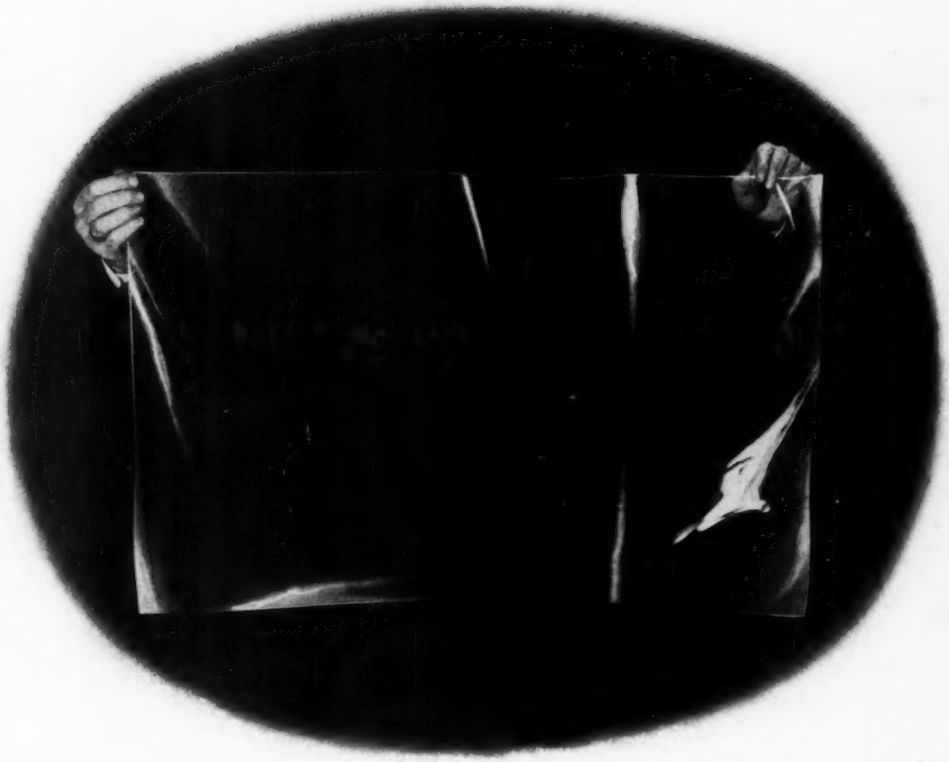
INJECTION MOLDING • METAL STAMPING • ELECTRO-MECHANICAL ASSEMBLIES



What are the Features you need in Plastic Sheet?

Lower Price?
Continuous Lengths?
Slow-Burning?
Easier Fabricating?

SEE THE NEW IMPROVED CELANESE* ACETATE SHEET

The applications for Celanese acetate are virtually limitless. This new, improved material is produced in a wide variety of gauges, sizes—in continuous lengths and sheets in clear and colored transparents, and solid colors.

Celanese acetate sheet is the ideal material for transparent containers, sun visors, goggles, motorcycle windshields, automobile side curtains, gauge and clock crystals, lampshades, children's record discs, toys, playing cards, hamper tops, handbag frames, X-ray mounts, pencil sharpeners and machine guards.

As originators and producers of plastic sheet since 1872, Celanese recommends this new material to manufacturers now using higher priced sheet.

Celanese Corporation of America, Plastics Division, Dept. 1-K, 180 Madison Avenue, New York 16. In Canada, Canadian Cellulose Products Ltd., Montreal and Toronto.

Celanese*

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PLASTICS

How to DISPENSE WITH EXPENSIVE DISPENSERS!

USE PLASTIC! Kellogg's new cereal dispenser . . . designed and produced by Prolon Plastics . . . costs less than old-fashioned, metal dispensers. Lighter to ship and handle, too! Bright, eye-catching colors; never needs repainting. Smooth, permanent finish; won't chip or rust!

TO FIND OUT HOW plastics can profitably serve you, consult Prolon Plastics . . . experts . . . *pioneers*, in fact, with more than 100 years' experience. Planning. Designing. Die-making. Molding of all types!

RIGHT OUT IN FRONT!
Kellogg's cereals are displayed attractively at lunch counters, etc., in new dispenser molded in specially designed sections for use in 1, 2, 3 or 4-shelf units according to available space.

ARE YOU USING PLASTICS PROFITABLY?

PROLON PLASTICS

PLANNING • DESIGNING • DIE-MAKING • MOLDING

PROLON PLASTICS, A DIVISION OF PRO-PHY-LAC-TIC BRUSH COMPANY, FLORENCE, MASS.

Completely Automatic!

NEW REED-PRENTICE 2 and 3 oz. Machines

The *new* 2 oz. and 3 oz. Reed-Prentice injection molding machines offer faster molding cycles than ever before obtainable. Dependant on product and mold construction, these fully automatic presses will produce 6 to 10 shots per minute with a minimum of rejects.

SPECIFICATIONS:

Die locking pressure tons	125
Rated casting area in mold, sq. in	50
Mold opens	4 to 8"
Maximum die space	12"
Size of die plates	16"x21"
Weight	9800 lbs.

Electrically operated automatic controls assure uninterrupted, rapid production and utmost safety. A special hydraulic safety device prevents any possible damage to the mold should a molded piece remain in a cavity. With these fully automatic features, one man can easily operate a battery of machines.

For more complete information on the fast-cycling 2 & 3 oz. Reed-Prentice presses, write Dept. "D" today or call in a nearby representative.

THE WORLD'S LARGEST MANUFACTURERS OF INJECTION MOLDING MACHINES

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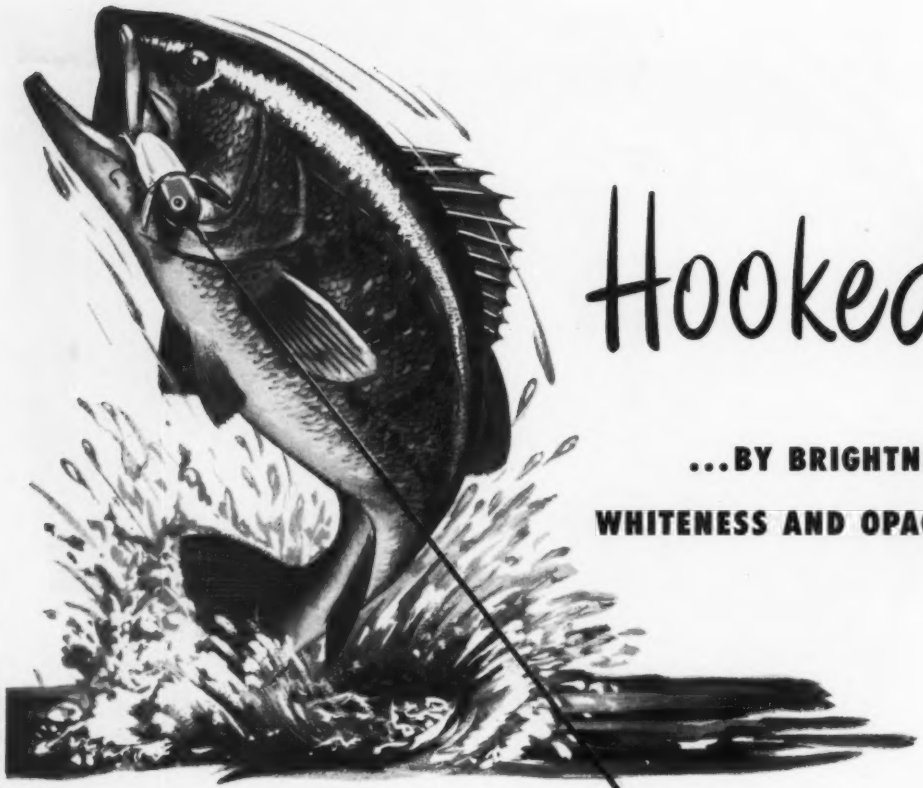


Hooked!

...BY BRIGHTNESS, WHITENESS AND OPACITY

It takes a *bright* luscious looking lure to entice a bite from today's sophisticated fish.

Plastic plugs pack a lot of piscene allure when they are pigmented with TITANOX. The rutile titanium dioxide pigment—TITANOX-RA—is specially recommended for brightening all kinds of plastic plugs. It affords any degree of opacity and adds a non-yellowing whiteness at low loadings that make plastic plugs highly attractive and visible even to dim-eyed old mossy-backs.

Our Technical Service Department is ready at any time to help you with your problems in pigmenting plastics—be they phenolics, cellulosics, ureas, polystyrenes or acrylics. Write or phone our nearest office today. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; 104 South Michigan Avenue, Chicago 3, Ill.; 2600 South Eastern Avenue, Los Angeles 22, Calif. Branches in all other principal cities.

8230

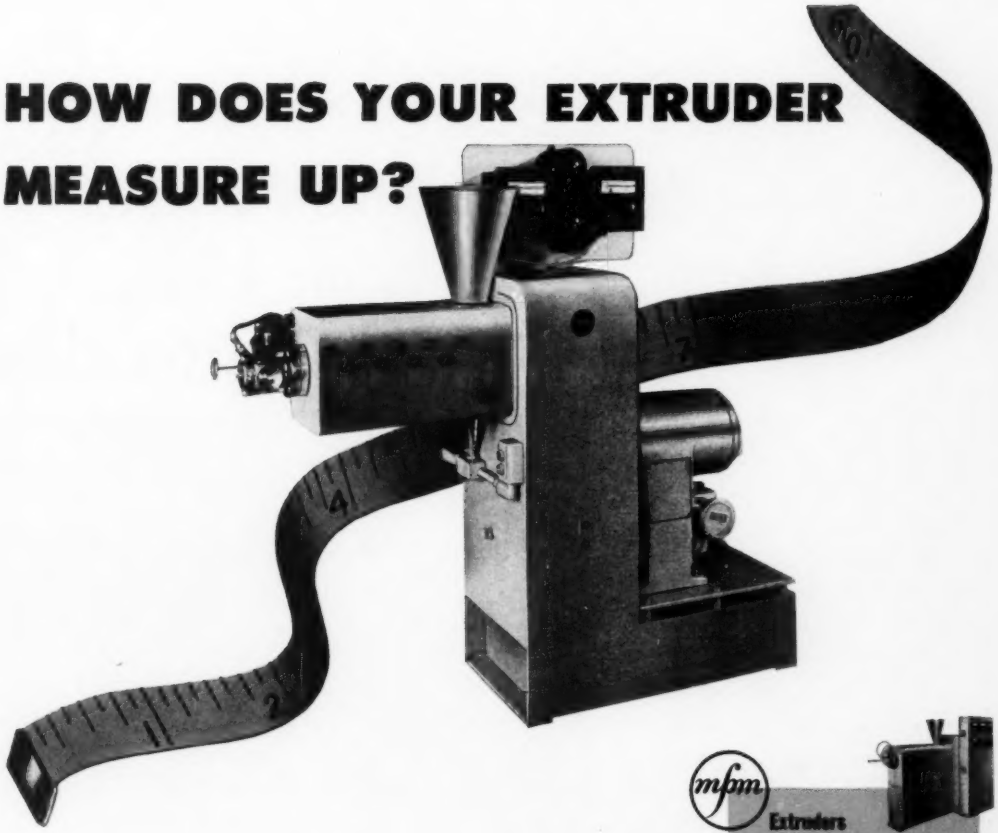
TITANOX

the brightest name in pigments

TITANIUM PIGMENT CORPORATION

Subsidiary of NATIONAL LEAD COMPANY

HOW DOES YOUR EXTRUDER MEASURE UP?



This is an invitation to make any sort of measurement you choose of an MPM extruder . . . Gauge its production. Check the variety of materials it extrudes. Compare its design and construction. Look into its heating and cooling system. Inspect its safety features.

When you've finished, you'll know the reasons leading plastics technicians select and recommend MPM extruders above all others.

The screws, strainers, cylinders and other vital parts of MPM extruders are not plated, but built of corrosion resistant materials through and through. And what's more, MPM extruders will handle the many new plastic materials *now being developed in materials suppliers' laboratories.*

The important design features of MPM extruders result in better products being extruded at less expense. Why not take our invitation. Find out how these *Modern* machines measure up to your production needs. Ask for full details.

mpm

Extruders sizes to fit most needs

2½"

greater thrust capacity

3½"

superior insulation

safety die head

built in speed indicator

4½"

dies available to order

modern plastic machinery corp. mpm

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FURFURYL ALCOHOL TYPE RESINS

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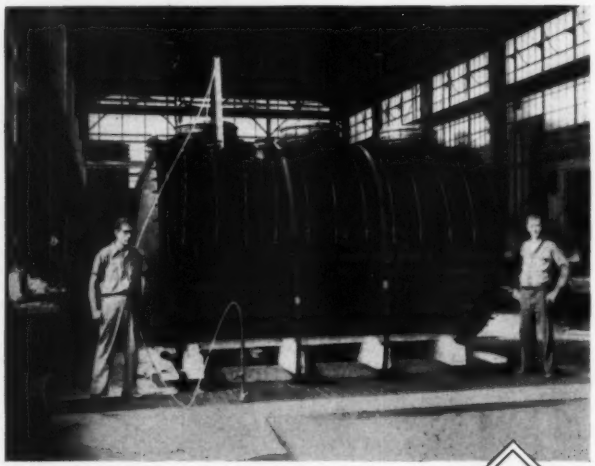
Haveg 60 equipment is formed from a mixture of furfuryl alcohol type resin and a special acid-digested asbestos. When cured the combination has excellent corrosion resistance, toughness, and durability. The chemical resistance is not merely a surface condition but exists throughout the mass. Haveg 60 is resistant to acids and to alkalies, including hot concentrated sodium and potassium hydroxide solutions.



Haveg 60 is made by Haveg Corporation, Newark, Delaware.

HAVEG

The product is formed in wall thicknesses from ¼" to 2" depending on the application. Units are molded in one seamless, jointless piece up to 12 feet deep for ten foot diameters and fifteen feet for smaller cross sections. Larger equipment is constructed by joining individual sections also possessing uniform corrosion resistance throughout.

The Quaker Oats Company does not manufacture furfuryl alcohol resins but is glad to put you in touch with suppliers. If you would like general information about furfuryl alcohol itself just ask for a copy of Bulletin 83-A.

The Quaker Oats Company — **CHEMICALS DEPT.**

337F The Merchandise Mart, Chicago 54, Illinois
Eastern Sales Office
1240F Whitehall Bldg., New York 4, N. Y.

In San Francisco, The Griffin Chemical Company In Australia, Swift & Company, Pty., Ltd., Sydney In Europe, Quaker Oats-Graanproducten N.V., Rotterdam, The Netherlands; Quaker Oats (France) S.A. 42, Rue Pasquier, Paris 8E, France

A COMPLETE LINE OF PLASTICS MOLDING MACHINERY

From 2... to 200 Oz

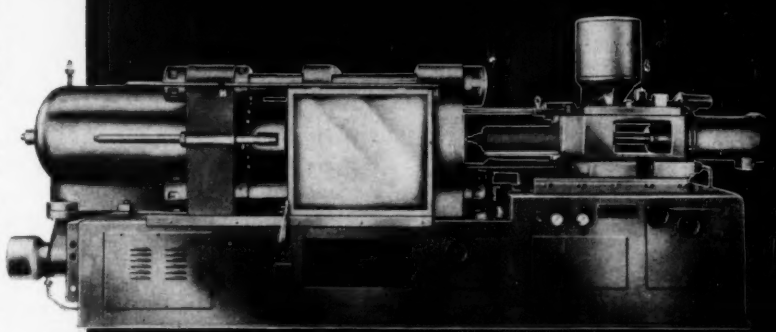
...and, all are obtainable from one source of supply—Watson-Stillman.

Since the very inception of the industry over 50 years ago, Watson-Stillman engineering ingenuity has paced the industry, year after year, with outstanding plastics molding machinery advancements.

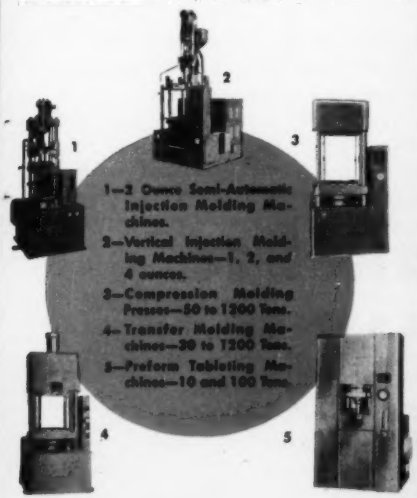
Today, from the W-S "COMPLETELINE" of Injection, Transfer and Compression Molding Machines, you can select a model to fit every production requirement—large and small.

And, W-S offers many additional services. Mold designs, material selection, operation, maintenance, plant layout, are all subjects about which W-S is in a particularly good position to give advice to its clients as a part of its "COMPLETELINE" service.

When planning plant extension or a new business, consult W-S *first* about plastics machinery and how to use it.



Horizontal Injection Molding Machines—8 to 120 Ounces



1—2 Ounce Semi-Automatic Injection Molding Machines.
2—Vertical Injection Molding Machines—1, 2, and 4 ounces.
3—Compression Molding Presses—50 to 1200 Tons.
4—Transfer Molding Machines—30 to 1200 Tons.
5—Preform Tableting Machines—10 and 100 Tons.

WATSON-STILLMAN

ESTABLISHED 1848 *HYDRAULIC MACHINERY DIVISION*

Factory and Main Office, ROSELLE, NEW JERSEY

Branch Office, CHICAGO, ILL.

Manufactured in Canada by CANADIAN VICKERS, Ltd., MONTREAL

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Required Reading

BEFORE you do anything else, fill out and mail the coupon below for your free copy of Bakelite Division's new "Simplified Guide to BAKELITE and VINYLITE Plastics and Resins."

Brought completely up to date, it is an encyclopedia of facts about the plastics most widely used in industry!

The 24-page booklet, with over ninety illustrations of typical applications of plastics and resins, contains valuable data on the characteristics, properties, and the many available forms of BAKELITE and VINYLITE Plastics and Resins.

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BAKELITE DIVISION
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FOR Custom-Moulded TEFLON PARTS LIKE THESE . . .

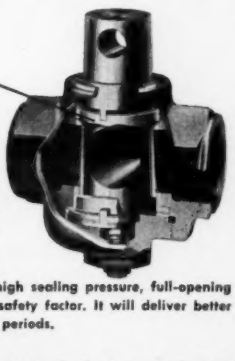
Moulded Teflon liners shown ¾ actual size.

SEE US!

This Teflon valve liner, moulded by Kurz-Kasch for The Duriron Company, Inc., takes full advantage of this most chemically inert of materials. It resists all known acids, alkalis, etc. Nothing known adheres to it. It will withstand a temperature of 500° F. continuously. It has zero water-absorption. It is non-toxic. And its moulded-in wax-like surface permits free turning without lubricants. Inasmuch as Teflon's electrical properties are also outstanding, applications in the chemical, electrical and food processing industries are suggested.

Here's the catch. Teflon cannot be moulded by conventional methods. Some parts are produced by machining, but this has drawbacks where a smooth wax-like surface is required. From the outset, we have worked closely with Durco engineers to produce parts such as these with uniform wall thickness, flange, and taper inside and out by a proved moulding technique. It consists of pressing preforms, sintering at 700° F., and coining.

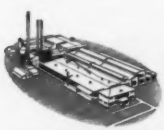
If you're interested in Teflon—or any other thermo-setting material—talk to a moulder who has grown up with them. We don't pretend to know all the answers, but we'll honestly, sincerely appraise your problem.



This revolutionary Durco Plug Valve, with its Kurz-Kasch-moulded Teflon liner, realizes to the fullest the astounding characteristics of this new material. It is virtually leak-proof, self-lubricating, and operates with high sealing pressure, full-opening round ports and a high safety factor. It will deliver better performance over longer periods.

Kurz-Kasch

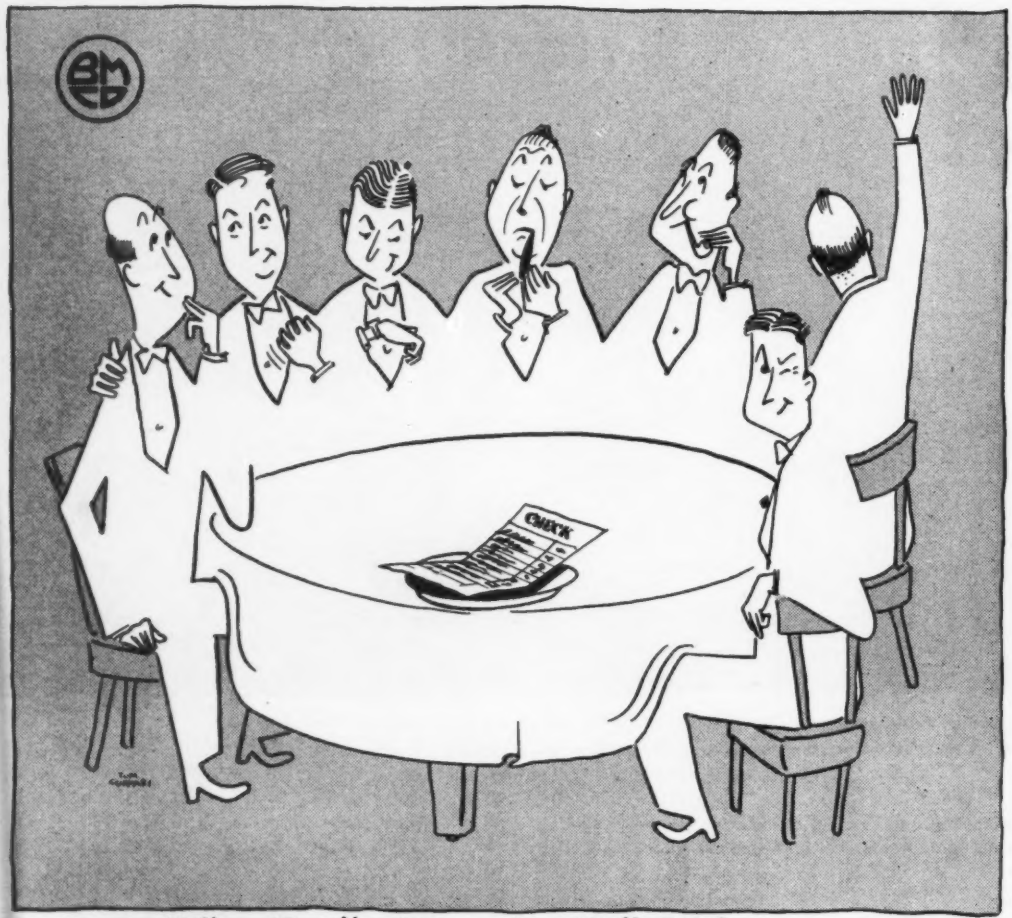
FOR OVER 34 YEARS PLANNERS AND MOULDERS IN PLASTICS



Kurz-Kasch, Incorporated • 1415 South Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, *Lexington 2-6677* • Chicago, *Harrison 7-5473* • Detroit, *Trinity 3-7050* • Philadelphia, *Granite 2-7484* • Dallas, *Lakeside 1022* • Los Angeles, *Prospect 7503* • St. Louis, *Delmar 9577* • Toronto, *Gladstone 5491.*

EXPORT OFFICE: 89 Broad Street, New York City, *Bowling Green 9-7751.*



Who Really Pays the Bill???

The music was lovely—the dinner superb—now who picks up the tab! If you are the manufacturer who is feeling smug over the terrific deal you just put over on the "poor" molder—who is going to design, tool and mold your product at a price you can buy peanuts for—Beware! Don't let those lovely visions of money in the bank or a promotion from the boss blind you.

While it may be cheap at first, you can be sure that in the long run . . . YOU will be stuck with the check—to the extent that you will not have enough simoleons left to buy the aspirin that you will need so badly when things start going wrong.

You would be leery of buying a Cadillac at the price of roller skates . . . so why risk your business and livelihood by thinking that plastics is any different from other sound business operations. Remember that you get just about what you pay for in this world.

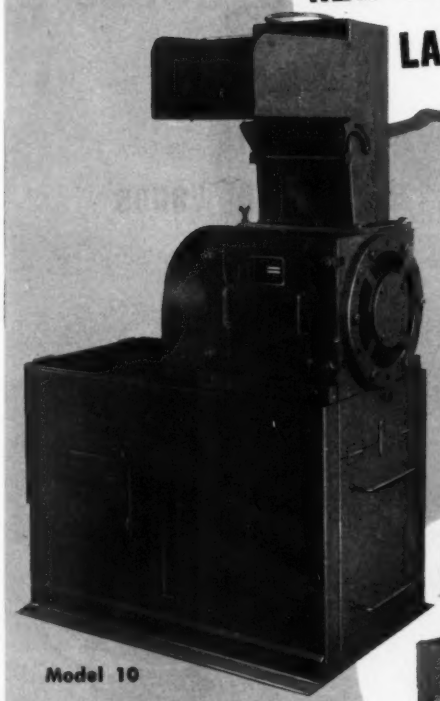
Which brings us to the point—that it costs no more to use the facilities of an established, seasoned molder like Boonton for the correct production of your plastic products. In fact, it costs less in that you receive full value for your dollars spent and have the advantages and benefits of an organization with over 30 years of sound engineering experience and proven ability in molding . . . that never appears on your invoice.

A typical test on a specific material or design problem will convince you that we fit into your plastics plans perfectly.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY N. Y. Office—Chanin Bldg., 122 East 42nd Street, Murray Hill 6-8540

NEW CUMBERLAND GRANULATOR HAS LARGE 6"x10" THROAT OPENING!

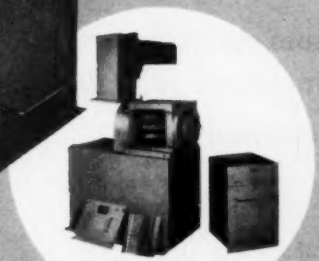


Model 10

DESIGNED FOR USE BESIDE EACH INJECTION MACHINE

Cumberland's new Model 10 granulating machine fills the urgent need for a high-quality granulator with a large throat opening to be used beside each injection molding machine.

Like all Cumberland machines, the new Model 10 is rugged, efficient, and easy to clean. And you'll appreciate its attractive price.

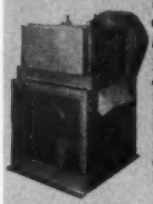


Dismantled View

SPECIFICATIONS
Throat opening: 6" x 10"
Motor: 3 HP, 1800 rpm
Floor space: 24" x 36"
Shipping weight: 1200 lbs.

Write for further information.

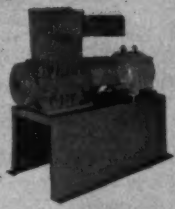
CUMBERLAND



ROTARY CHOPPING MACHINE

Heavy duty, rugged machine. Used for cutting thick vinylite slabs from two roll mills. Also used as large capacity pelletizer. Other applications are described in Bulletin 400.

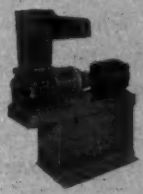
CUMBERLAND



GRANULATING MACHINE MODEL 18

Large capacity. Double hung construction. Easy to inspect, dismantle, and adjust. Further details are in Bulletin 250.

CUMBERLAND



GRANULATING MACHINES MODELS 0, ½, 1½

Small and medium capacity. Designed specifically for plastics. Rugged and easy to clean. Request Bulletin 250.

CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

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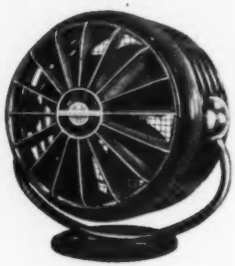
Westinghouse

designed plastic air jet vanes help solve AIR CIRCULATION PROBLEMS

BRIDGEPORT MOULDED AIR JET VANES GIVE NEW Westinghouse *Whirlaire*® FANS AMAZING AIR PENETRATION



The new Whirlaire fans solve the toughest air circulation problems. With mesh-woven grilles, the Whirlaire throws a flood of air right in front of fan. When grille is replaced by plastic Air Jet Vane, the air stream penetrates in a straight line to amazing new distances. Never before has a fan given such complete circulation!

The new Air Jet Vane is injection moulded of Dow #475 Styrene to meet the famous strict specifications of Westinghouse. Moulded in two sizes 17″ and 22″ in diameter. Just another example of the scope and ability of Bridgeport plastic moulding services. Perhaps we can help you, too. Write today to . . .

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

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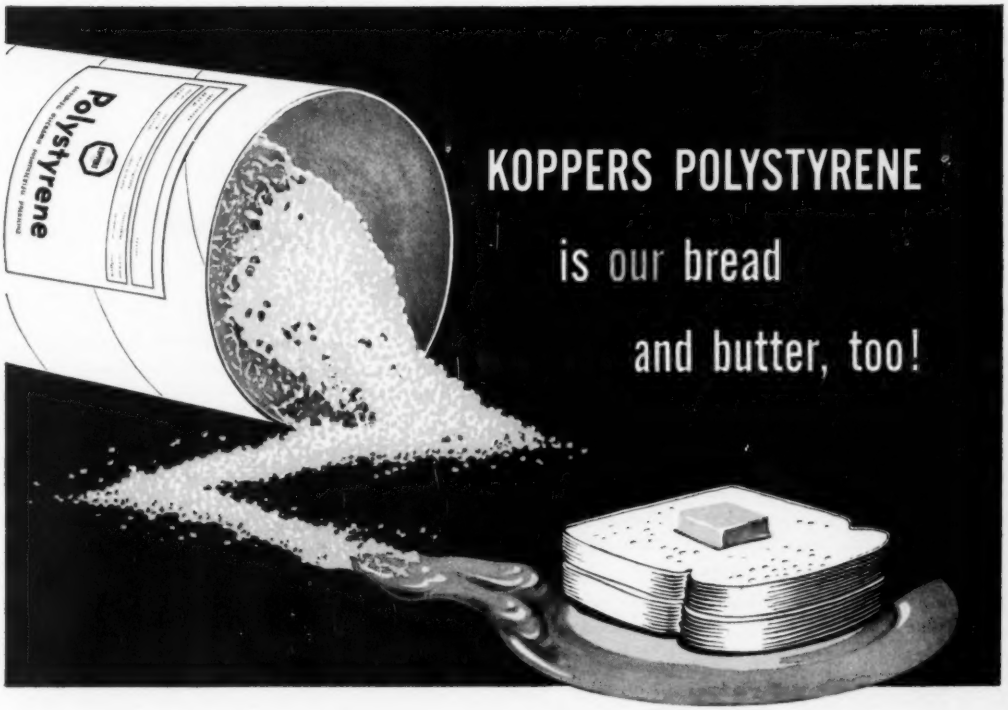

To molders of Koppers Polystyrene:

Since Koppers Polystyrene was introduced, demand has been near production capacity. However, since April, 1950, the situation has been acute. Total molding capacity had been and continues to be increased in the face of a growing shortage of raw materials.

To assure our customers a proper share of available supplies, a system of allocation of Koppers Polystyrene was set up. This is the plan:

Each customer's average monthly purchase during the period from January 1949 through March 1950 was determined. This average monthly figure was set up as his monthly allocation base.

Each customer's orders since March have been filled to the extent of his allocation base.

We plan to continue this policy. However, governmental needs, regulations or other conditions beyond our control may require either modification of bases or change in policy. Under any circumstances we shall endeavor to apportion the available supply equitably among our customers.

As always, we want to work with you to obtain the best results from your use of Polystyrene . . . to solve your particular molding problems (with special attention to military end uses) . . . to design new products to be made from Koppers Polystyrene when the supply situation again becomes more normal.

KOPPERS

Koppers *Perfected* Plastics

Koppers Polystyrene has made Many Products Better and Many Better Products Possible.

KOPPERS COMPANY, INC., Chemical Division, PITTSBURGH 19, PA.

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TINNERMAN

Speed Nut Savings Stories

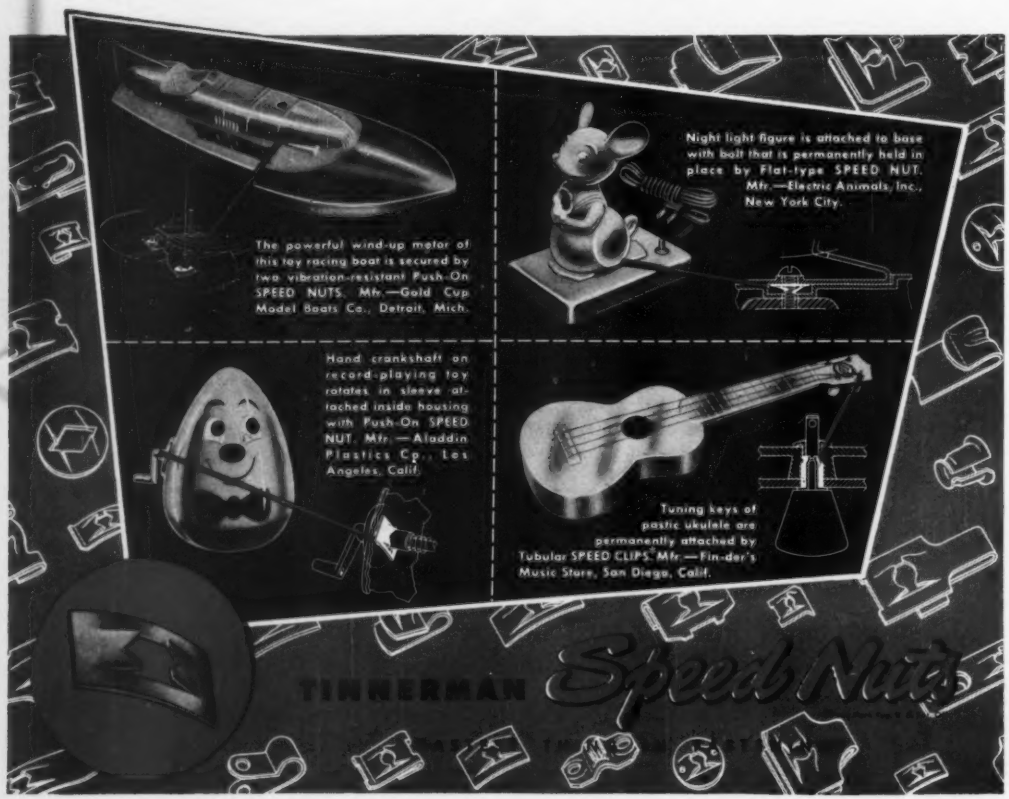
IS YOUR PRODUCT next?

Whatever you manufacture in plastics, SPEED NUTS can provide a better, faster, easier assembly method

Everywhere you look today, there are examples of SPEED NUTS at work with plastics. The four shown on this page are typical of the adaptability of SPEED NUTS to plastics attachments.

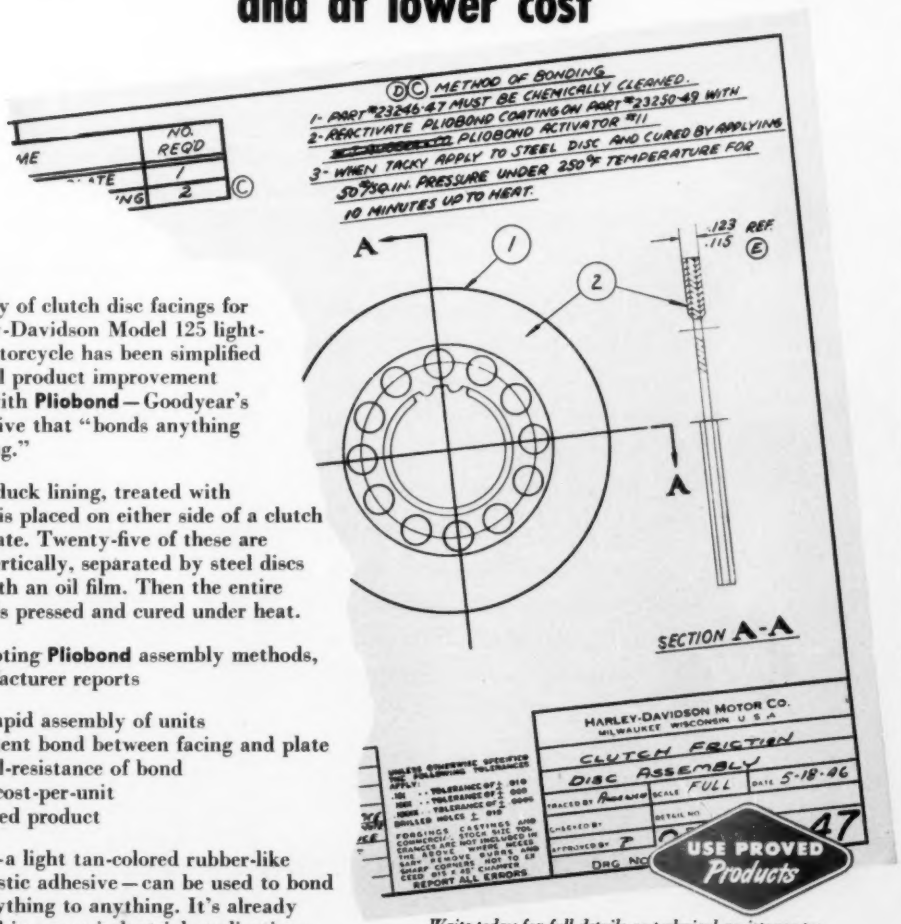
The preference for SPEED NUTS is easy to understand when you consider a few of their inherent advantages: They permit greater design flexibility, eliminate threaded inserts, harness cold-flow tendencies, eliminate heat sealing, and minimize assembly damage.

Think what these can mean in terms of cost savings on your products. Your Tinnerman representative will gladly help you work this out. Ask him to call—and write for your copy of SPEED NUT Savings Stories. Tinnerman Products, Inc., P.O. Box 6688, Cleveland 1, Ohio. In Canada: Dominion Fasteners Limited, Hamilton. In Great Britain: Simmonds Aerocessories, Ltd., Treforest, Wales.


The powerful wind-up motor of this toy racing boat is secured by two vibration-resistant Push-On SPEED NUTS. Mfr.—Gold Cup Model Boats Co., Detroit, Mich.
Night light figure is attached to base with bolt that is permanently held in place by Flat-type SPEED NUT. Mfr.—Electric Animals, Inc., New York City.
Hand crankshaft on record-playing toy rotates in sleeve attached inside housing with Push-On SPEED NUT. Mfr.—Aladdin Plastics Co., Los Angeles, Calif.
Tuning keys of pastic ukulele are permanently attached by Tubular SPEED CLIPS. Mfr.—Fin-der's Music Store, San Diego, Calif.
TINNERMAN Speed Nuts

Pliobond

makes a better clutch facing quicker and at lower cost



Assembly of clutch disc facings for the Harley-Davidson Model 125 lightweight motorcycle has been simplified—and final product improvement gained—with **Pliobond**—Goodyear's new adhesive that "bonds anything to anything."

A canvas duck lining, treated with **Pliobond,** is placed on either side of a clutch friction plate. Twenty-five of these are stacked vertically, separated by steel discs treated with an oil film. Then the entire assembly is pressed and cured under heat.

Since adopting **Pliobond** assembly methods, the manufacturer reports

1. More rapid assembly of units
2. Permanent bond between facing and plate
3. High oil-resistance of bond
4. Lower cost-per-unit
5. Improved product

Pliobond—a light tan-colored rubber-like thermoplastic adhesive—can be used to bond almost anything to anything. It's already use-proved in many industrial applications, and may well be the answer to your own most puzzling bonding problems.

Write today for full details or technical assistance to:

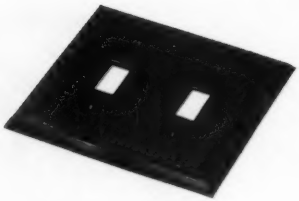
GOODYEAR, CHEMICAL DIVISION
AKRON 16, OHIO

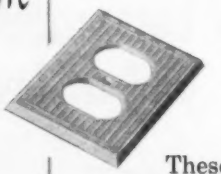
We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

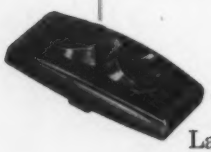
GOODYEAR

Pliobond—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

PASS & SEYMOUR ...design for Automatic Molding

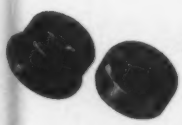






These plastic electrical parts . . . all *designed* for molding on Stokes completely automatic presses . . . are produced by Pass & Seymour, Inc., Syracuse, N. Y.

Labor and material savings are large. Inventory is geared to daily requirements. High speed, long run automatic molding is foolproof, flexible, economical. Stokes fully automatic molding presses produce superbly finished identical parts, accurate in dimension, simple or complex, thin-wall or heavy section . . . at extraordinarily low costs.



Stokes offers assistance in part and mold design, plastics material selection, and choice of molding equipment . . . all for profitable production. Blueprints or parts are welcome for impartial design-and-cost analysis.

STOKES MAKES Automatic and Semi-Automatic Molding Presses, Plunger Presses, Closure Presses, Preforming Presses, Industrial Tabletting and Powder Metal Presses, Vacuum and Special Processing Equipment, Water Stills and Special Machinery.

F. J. STOKES MACHINE COMPANY

5934 TABOR ROAD

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F. J. STOKES MACHINE CO.
5934 TABOR ROAD
PHILADELPHIA 30, PA.

Please . . . a copy of Bulletin No. 500 describing the NEW Stokes No. 741 Completely Automatic Molding Press.

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COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____ DY

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Sheets • Rods • Tubes

cellulose acetate (Nixon C/A)
cellulose nitrate (Nixon C/N)
ethyl cellulose (Nixon E/C)
cellulose acetate butyrate (Nixon C/A/B)

Molding Compounds

cellulose acetate
ethyl cellulose

rigid VINYL sheeting
(Nixon V/L)

for close personal service on orders large or small, contact...

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Chicago Office: 510 N. Dearborn Street, Chicago 10, Ill.

DME "has what it takes..."

...to *finish cavities*...

TAPERED MILLING CUTTERS

END MILLS—SPRUE REAMERS

A complete line of polishing supplies

DIAMOND COMPOUND—LUBRICATOR

POLISHING STICKS—APPLICATOR GUNS

ABRASIVE STONES—ABRASIVE POWDER

MOLD POLISHING COMPOUND

ABRASIVE CLOTH BENCH ROLLS

...and *fill* <u>all</u> *your moldmaking needs*...

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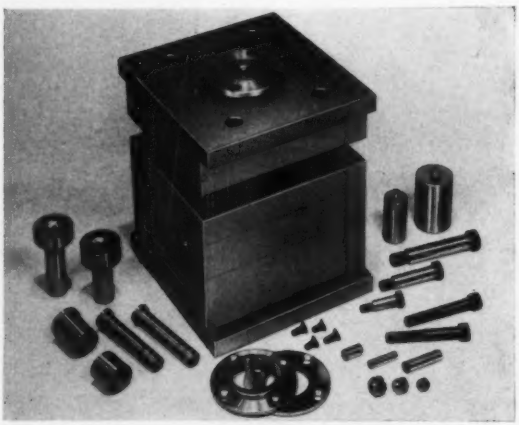
BRASS PRESSURE PLUGS—BAFFLES



THE ORIGINATORS OF STANDARD MOLD BASES AND MOLD MAKERS' SUPPLIES

SEND FOR THE NEW SUPPLEMENTARY CATALOG W OF MOLDMAKERS' SUPPLIES

DETROIT MOLD ENGINEERING CO.

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CHICAGO 44, ILL.

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5473 Lake Court
CLEVELAND 14, OHIO

NEW developments in dry coloring

LUSTREX Colorant Blend

NOW SUITABLE FOR INDUSTRIAL APPLICATIONS

Here's real news! Monsanto's *special* styrene plastic molding compound for dry coloring—Lustrex Colorant Blend—has a far greater range of applications than previously thought possible. At least one out of every two colored items can be satisfactorily produced . . . at substantial savings . . . with this new material.

Already, molders are dry coloring television masks, wall tile, clock cases, electrical cord plugs, thermometer housings, vacuum cleaner parts, utensil handles and many other applications. It will pay you to investigate the economies of dry coloring and Monsanto's Lustrex Colorant Blend styrene plastic for industrial as well as other uses.

For latest information:

Send for this new booklet

—TODAY!

Here's the latest, most comprehensive booklet on dry coloring. It describes new molding techniques and coloring aids; methods; procedure. Types, sources and prices of colorants and equipment listed. For your free copy—just mail the handy coupon. Lustrex: Reg. U. S. Pat. Off.

SERVING INDUSTRY
...WHICH SERVES MANKIND

MONSANTO
CHEMICALS—PLASTICS

MONSANTO CHEMICAL COMPANY, Plastics Division, Dept. MPLP 35 Springfield 2, Mass.

Please send me "Latest Developments in Dry Coloring of Monsanto Lustrex Colorant Blend Molding Compound."

Name and Title

Company

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Hydraulic PRESSES

Bethlehem

WILL PLAN AND BUILD THEM FOR YOU, OR BUILD TO YOUR OWN DESIGN

You're in complete command when you commission Bethlehem to build your hydraulic presses.

If you choose to have us supply the design, we'll be glad to. We've been planning hydraulic machinery for years, and our engineering staff is one of the best in the business. On the other hand, if you prefer to follow your own design, Bethlehem will adhere faithfully to your specifications. The press will be as you order it, down to the last detail.

Our shops are equipped with every modern facility needed in the building of hotplate, molding, and metal-forming presses. These machines can be built self-contained, or with separate hydraulic power plant, or without power equipment if the customer wishes to furnish his own.

Whether it's one press or a whole battery, call on Bethlehem. We are prepared to do the job to your complete satisfaction.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

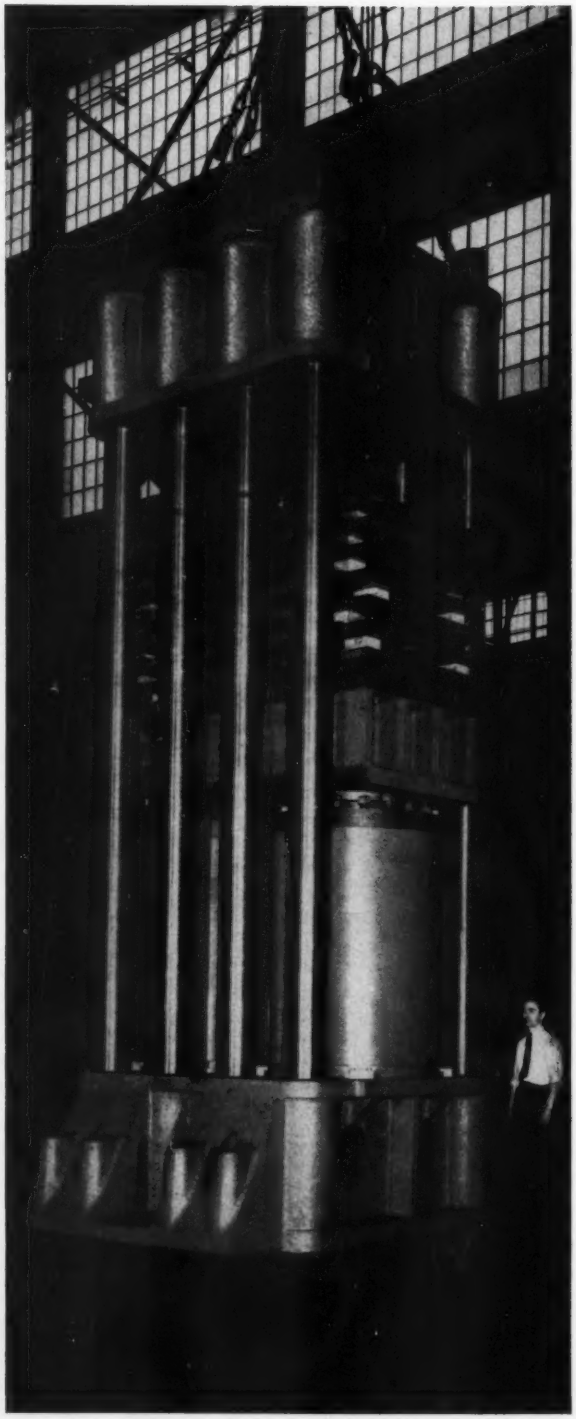
BETHLEHEM STEEL

BETHLEHEM

Custom-Built

HYDRAULIC PRESSES

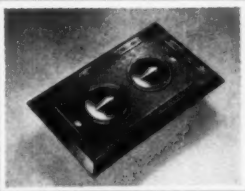
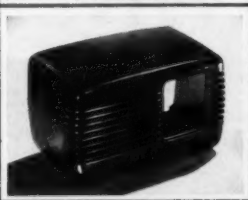
FOR PLASTICS • LINOLEUM • FIBER BOARD
WALLBOARD • METAL-FORMING • VULCANIZING



HOW TO CHOOSE YOUR

GENERAL PURPOSE

PHENOLIC MOLDING COMPOUND

What do you make?		Properties you need	DURITE recommends
Household items—appliance housings, toilet seats, domestic wiring devices.		Good finish, moderate strength, fast cure, low cost.	For long draw: 560 For short draw: 528 Black or brown
Photo, sports equipment, toys—camera cases, developer trays and tanks, fishing reel parts, etc.		Good finish, moderate strength, fast cure, low cost.	For long draw: 560 For short draw: 528 Black or brown
Cabinets and cases, radio cabinets, novelty cases, playing card cases, etc.		Good finish, moderate strength, fast cure, low cost.	Walnut mottle: 606 Mahogany mottle: S-3261 Black or brown: 560
Telephone hand sets (and other parts requiring deep, black finish—piano sharps, etc.)		Good finish for buffing and polishing. Absence of specks.	For moderate strength: 525 For higher strength: 702 Black
Closures (Bottle caps)		Good finish, fast cure, good torque strength.	Stripping type: 539 Minimum odor: 650 Best finish: 651 Black or brown

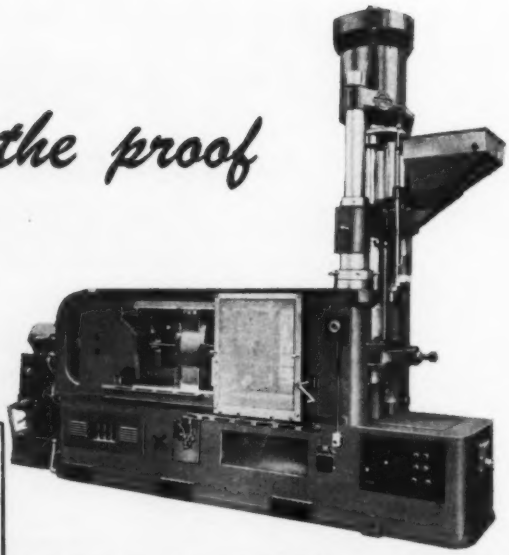
FREE: Write for catalog, fully describing the wide range of DURITE phenolics for General Purpose, Heat Resistance, Electrical Resistance, Impact Resistance—and made-to-order modifications of standard materials embodying special characteristics to meet your specific requirements. Address:

THE BORDEN COMPANY • CHEMICAL DIVISION
Dept. MP-110, 350 Madison Avenue
New York 17, N. Y.

DURITE

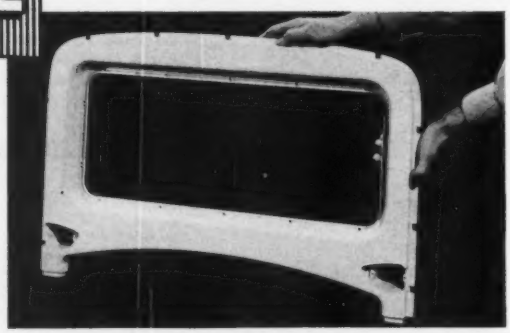
Molding Powders • Bonding Resins • Cements

Here's the proof



32 OZ ON A LESTER MACHINE IN POLYSTYRENE

Write for your Free Copy of The Lester Press



Lester machines are among the few rated exclusively in polystyrene. That is, a Lester machine will shoot its full rated capacity in polystyrene on a regular cycle—*without changes in feeding method or mechanism!* Thus, a 32 ounce Lester will displace about 40 ounces in acetate.

The shot shown here is a 32½ ounce refrigerator frame molded of white high impact polystyrene by Cambridge Molded Plastics of Cambridge, Ohio, on a 32 ounce Lester. Although the deep wells at the bottom of the piece might have presented a problem, it ran successfully on installation. For that *extra* value in all phases of injection molding, depend on Lester Injection Molding Machines.

LESTER INJECTION MOLDING MACHINES

distributed by LESTER-PHOENIX, INC., 2621 CHURCH AVENUE • CLEVELAND 13, OHIO

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Toronto, Canada . Modern Tool Works, Ltd.
London, England . . Dowding & Doll, Ltd.
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DRYCOL

– is not magic!
– it only SEEMS so!

for EASY, ON-THE-SPOT COLORING of **CRYSTAL STYRENE**

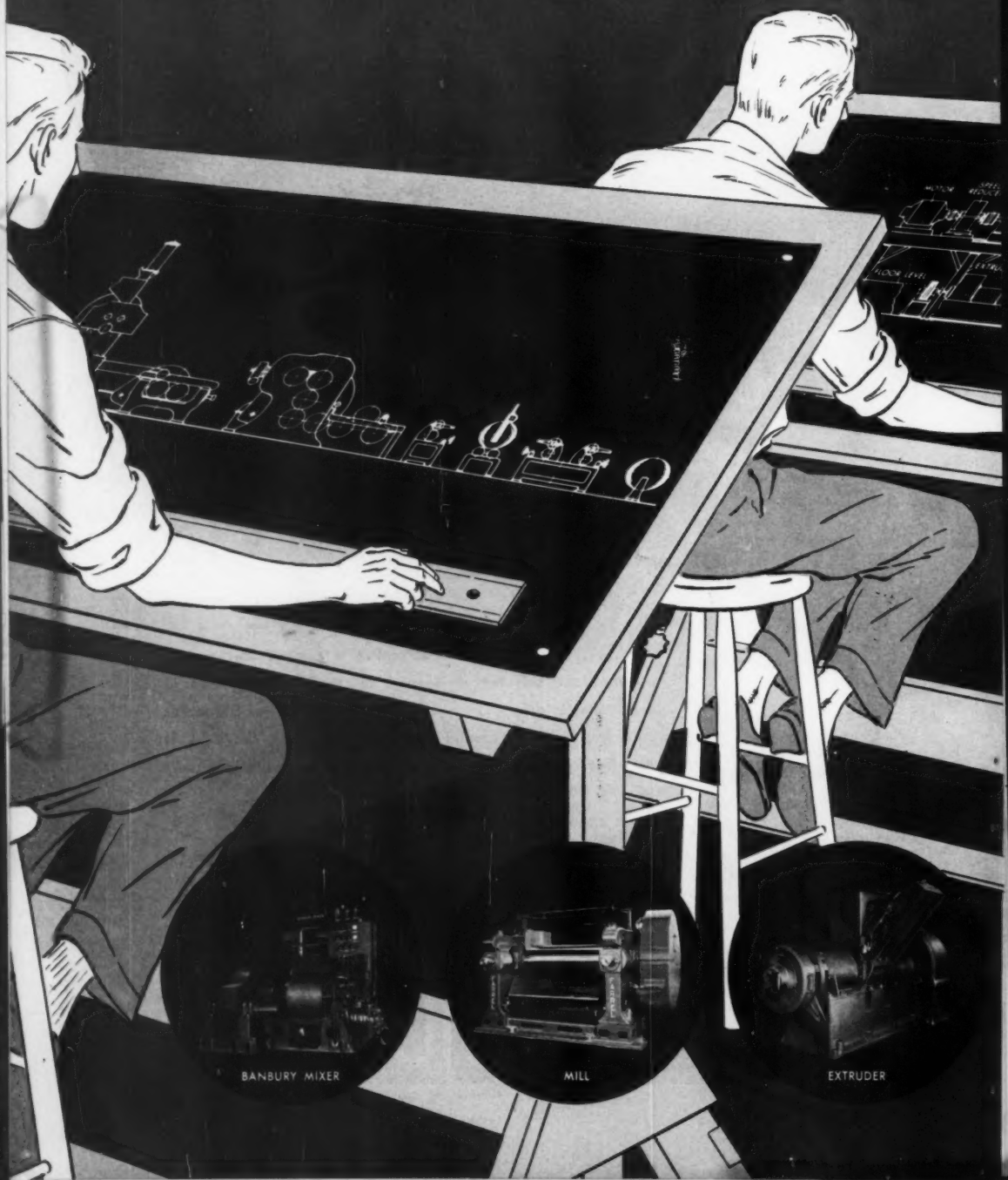
No! . . . Not MAGIC. Drycol is a perfect on-the-spot, in-your-plant colorant developed by Gering, specialists in thermoplastic coloring. We supply 17 Bureau of Standards colors, as well as special shades to order. DRYCOL is dust-free, compact, economical; supplied in convenient units to color 50 and 100 lbs. of styrene in any mixing drum, ready to mold.

Call on our Technical Service department for recommendations.

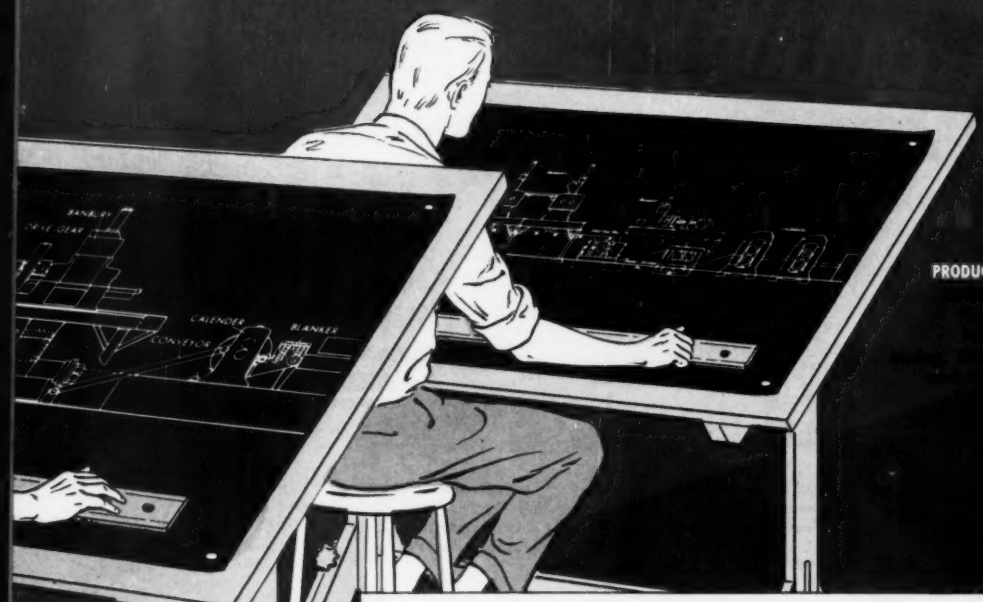
SAMPLE PACKET for 100 pounds furnished GRATIS

GERING *Products Inc.*
KENILWORTH, N. J.

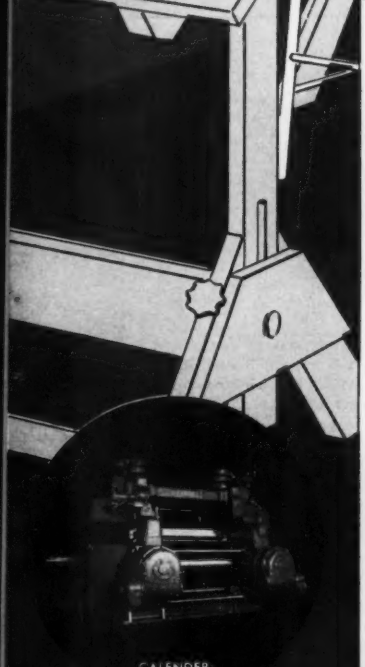
FARREL-BIRMINGHAM ENGINEERS ARE READY



TO HELP SOLVE YOUR PROCESSING PROBLEM, TOO



F-B
PRODUCTION UNITS



CALENDER

The Farrel-Birmingham Engineering Department is staffed by men with special training in the design of processing machinery. A part of this department, the Engineering Planning Division, is maintained for those manufacturers who contemplate expansion or adjustment of plant facilities or new plant construction.

The three production layouts, shown on the drawing boards, are typical of the service performed by this division. Developed from start to finish by F-B engineers, these layouts include a unit consisting of three matched production machines for processing plastic film and coatings; a layout for the production of blanks from which phonograph records are made; and a setup for synchronizing production through the progressive steps in the manufacture of asphalt tile flooring.

Hand-tailored for specific conditions, these installations are planned to improve production efficiency and reduce handling costs. They are composed of units — such as Banbury mixers, mills, calenders and extruding machines — designed for most efficient step-by-step conversion of raw materials to finished or semi-finished products. The various machines are *matched in capacity* to assure an even flow of production without "starving" or "choking" of succeeding machines. Manual aid and supervision are reduced to a minimum.

Farrel-Birmingham engineers will be glad to discuss the possibility of improving your production efficiency and cutting your handling costs through planned processing flow. Why not call on them today?

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham®

The NEW way to BETTER LABELING by CHICAGO SHOW PRINTING COMPANY

This MYSTIK Label identifies and sells, and gives important instructions to the consumer. It's beautifully printed in three colors and acetate laminated, for a striking, rich-looking label.

This is the permanent trade mark label on the popular Burgess Vibra Sprayer. Printed in sparkling colors and laminated. Self-Stik MYSTIK means fast production-line application and lifetime beauty.

Quality products deserve the quality label . . . MYSTIK. This rich-looking label is easily applied to THERMOS Vacuum Ware, it really stays put, but can be removed as needed.

This MYSTIK Self-Stik Label does a three-way job at the point-of-sale . . . it informs, it sells, it identifies. Because it's a MYSTIK Label, it goes on fast and stays put . . . won't curl or fall off.

Let us suggest a MYSTIK Label for your product—for identification, for point-of-sale selling or instructions. Self-Stik MYSTIK LABELS speed hand labeling, solve your hard-to-label problems. They stay put, but if necessary are removable without a trace. They can be printed beautifully in colors, embossed, die-cut to all shapes and sizes. Write for samples and free booklet.

Mystik Self-Stik LABELS

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The

PARAPLEX "P" SERIES RESINS

FREE BOOKLET
Here—into 21 pages, 7 tables, and 2 graphs—we've squeezed the work of three years in field and laboratory. Successor to "Paraplex for Laminating, Molding, and Casting Applications" (1947), this new booklet describes the physical properties of the resins; tells you how to compound and cure them; how to choose accelerators, catalysts, dyes, pigments, and fillers. It discusses room-temperature and elevated-temperature curing methods. Then, in a description of the applications of the PARAPLEX "P"-series resins in laminating, casting, and molding, it brings fresh ideas to your work
Write to Dept. MPL-1, now, and your free copy will be in your laboratory in a few days.
CHEMICALS FOR INDUSTRY
PARAPLEX is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

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informative labeling in action...

THEY'RE UNBREAKABLE! And the customer is told so by the *Kum-Kleen Label on the product.*

THEY'RE BOILABLE! And again the customer is told so by the *Kum-Kleen Label on the product.*

A SALE IS MADE because the customer is told the facts by the *Kum-Kleen Label on the product.*

HERE IS AN EXCELLENT EXAMPLE of informative labeling on-the-counter salesmanship *in action*... from Plastics Manufacturing Corp. of Los Angeles. With Mrs. America as its sales target, Plastics Manufacturing tells her their line of plastic ware is both boilable and unbreakable. Here is why they selected *Kum-Kleen*, the labels that are applied with production-line speed at a fraction of the on-the-product cost of ordinary labels. They stick and stay stuck to all plastics without heat or moistening . . . yet are removable without harmful scraping.

Plastics Manufacturing is just one of the many manufacturers who are giving their products the advantages of *Kum-Kleen* informative labeling at remarkably low on-the-product cost.

Write for samples and prices

Kum-Kleen®

AVERY ADHESIVE LABEL CORPORATION

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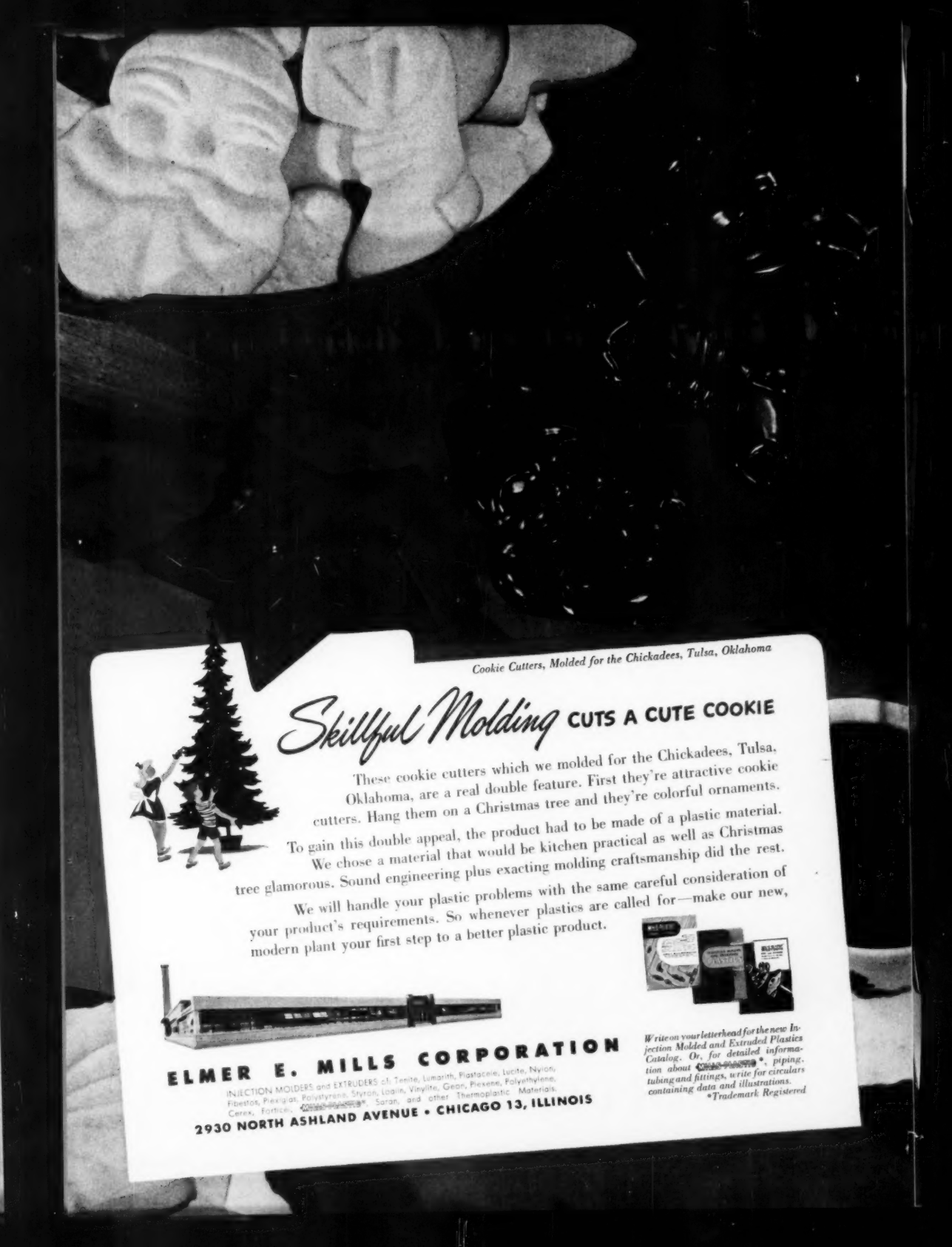
CLEVELAND: 2123 East 9th Street
PHILADELPHIA: 1069 Commercial Trust Building
CHICAGO: 608 South Dearborn Street
MONROVIA, California

Representatives In All Principal Cities



Cookie Cutters, Molded for the Chickadees, Tulsa, Oklahoma

Skillful Molding CUTS A CUTE COOKIE

These cookie cutters which we molded for the Chickadees, Tulsa, Oklahoma, are a real double feature. First they're attractive cookie cutters. Hang them on a Christmas tree and they're colorful ornaments.

To gain this double appeal, the product had to be made of a plastic material. We chose a material that would be kitchen practical as well as Christmas tree glamorous. Sound engineering plus exacting molding craftsmanship did the rest.

We will handle your plastic problems with the same careful consideration of your product's requirements. So whenever plastics are called for—make our new, modern plant your first step to a better plastic product.

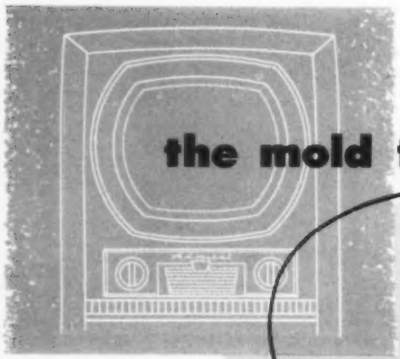
ELMER E. MILLS CORPORATION

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastacele, Lucite, Nylon, Fibestos, Plexiglas, Polystyrene, Styron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Cerex, Fortiflex, Cross-Spectra*, Saran, and other Thermoplastic Materials.

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about Cross-Spectra, piping, tubing and fittings, write for circulars containing data and illustrations.*

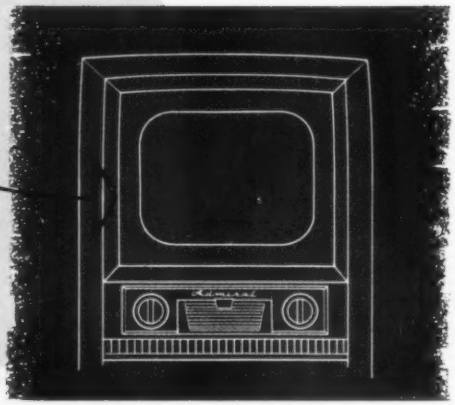
**Trademark Registered*



the mold that "grew" 1½ inches

Cabinet for Admiral 14" Television Console

Height: .....34 in.
Width: .....18 in.
Depth: .....18¼ in.
Weight: .....40 lbs.



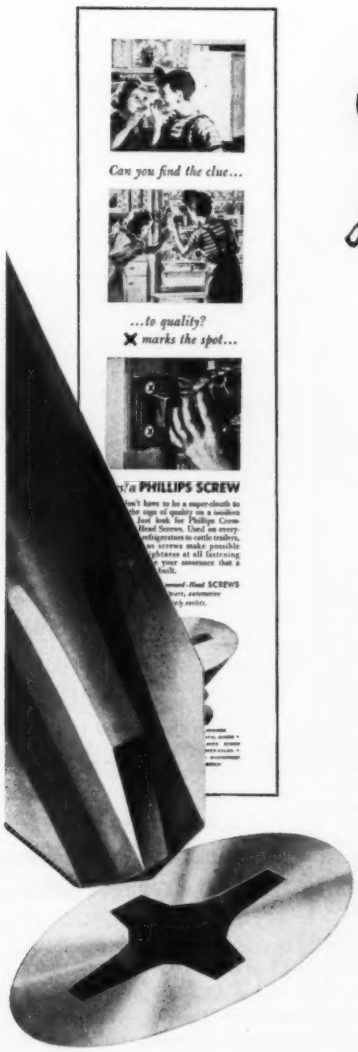
...produced by MPc for Admiral Corporation

Earlier this year, Admiral took the television industry by storm with the first 12½ inch receiver housed in a plastic console...molded by **MPc.** At that time, today's larger picture screens were already "on the boards." With an alert eye to the future, Admiral asked **MPc** to design the 12½ inch molds for ready conversion to larger tube sizes.

Here is the result. With the substitution of a new face plate, the 12½ inch molds "grew" to 14 inch size.

We welcome such challenges, here at **MPc.** Inventive engineering...plus tooling and production facilities to handle the "big ones"...can make plastics perform to *your* commercial advantage. Submit your plastics product or problem to Molded Products Corporation, 4535 W. Harrison St., Chicago 24, Ill.

PLASTICS DIVISION
MOLDED MPc PRODUCTS
CORPORATION



Does your product have this clue to quality?

Use of Phillips Screws proves extra care in manufacture

Production men know. Design engineers know. Purchasing agents know. AND NOW THE PUBLIC KNOWS that . . .

X marks the spot . . . the mark of *extra* quality. The identifying X formed by the cross-recess on the head of every Phillips Screw.

14 million readers of The Saturday Evening Post are being urged to look for this clue to quality in modern, well-built products.

Phillips Screws make your product stronger, better looking. They eliminate jagged burrs, split screw heads, make production power driving possible. Whether you use Phillips wood screws, machine screws or tapping screws you gain time, money, work-hours.

◀ Current advertisement on Phillips Screws appearing in The Saturday Evening Post.

PHILLIPS *Cross-Recessed-Head* **SCREWS**

X *marks the spot . . . the mark of extra quality*

AMERICAN SCREW CO. • THE BLAKE & JOHNSON CO. • CAMCAR SCREW & MFG. CORP.
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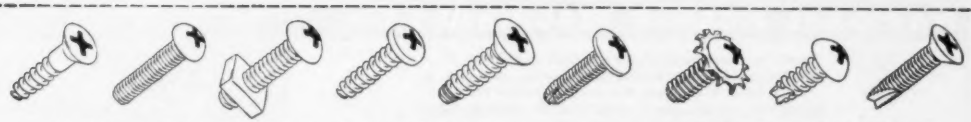
PHEOLL MANUFACTURING CO. • ROCKFORD SCREW PRODUCTS CO. • SCOVILL MANUFACTURING CO.
SHAKEPROOF INC. • THE SOUTHINGTON HDWE. MFG. CO. • WALES-BEECH CORP.



THE FASTENERS OF TODAY . . . AND OF THE FUTURE

PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO NRM REDUCE YOUR COSTS

NEW NRM TWO-STAGE EXTRUDER ELIMINATES INITIAL COMPOUNDING AND DRYING

Saves time and premium cost securing special short order mixtures

Another NRM "first" to further simplify extruding operations . . . to save on production time . . . to cut your manufacturing costs. Once again the pioneer in its field, the new NRM Two-Stage Extruder introduces a new development for drying and extruding pre-blended wet acetate acrylic and polystyrene compounds to be pelletized direct at the die or in a chopper.

By eliminating the need for initial compounding and drying, it now becomes possible for any plant to mix its own compounds to customer's specifications and at lower cost. In addition, less expense is involved for maintenance and labor formerly needed to operate more expensive equipment.

Premium costs of specially mixed short orders are no longer necessary. Compounds can be quickly made from a simplified inventory of basic materials such as resins, plasticizers, stabilizers, fillers and dies.

Substantial savings in production time can be realized also with the new NRM Two-Stage Extruder. Shorter delivery can be quoted since reliance on outside sources for availability of ingredients and compounds is avoided.

The first single screw extruder to incorporate colloiding, devolatizing and extruding, this new development is similar in design and operation to standard NRM plastic extruders. Existing NRM extruders now operating in the field can be modified to incorporate the many time and cost saving features of the new NRM Two-Stage machine. For complete details, simply write Plastics Machinery Division, National Rubber Machinery Company, Akron 8, Ohio.

ELECTRICALLY HEATED EXTRUDER PROVIDES POLYETHYLENE FILM IN ANY SIZE

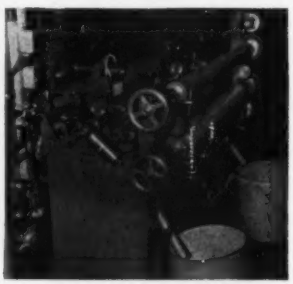
NRM 72" Cooling, Haul-Off and Dual Wind-Up Stand for Flat Film

NRM Haul-Off and Wind-Up Units cool, trim and wind up polyethylene film at a rate of 250 to 300 pounds per hour . . . have a thickness range of .001" to .010" and maintain tolerances of plus or minus 5%. They are available in 48" and 72" sizes.

Haul-off and wind-up sections are powered by a ¾ h.p. variable speed drive to suit the size of extruder used in connection with the machine. Dies for polyethylene film used with this take-up fit all sizes of extruders and are available complete with heaters and controls.

The cooling tank is stainless steel and is adjustable vertically so that it can be lowered to facilitate adjusting the die.

Haul-off section includes rubber covered "nip" rolls, idler tension roll, chrome plated trim roll and one set of rotary trimming knives. Dual wind-up section has two spindles arranged for quick, easy exchange of full rolls, driven by an adjustable slip clutch to compensate for build up on roll and equipped to accommodate standard cardboard core.



Close-up View of NRM 48" Dual Take-up for Polyethylene Film

For maximum plant flexibility, the equipment is designed to be compact, light yet rugged . . . occupies little floor space and can be moved on casters. The working position, however, is on jack screws. Additional data is available. Write Plastics Machinery Division, National Rubber Machinery Company, Akron 8, Ohio.

Equipment For Polyethylene Lay-Flat Expanded Tubing

The wind-up is available in 48" and 72" sizes, complete with dies for all sizes of extruders.

To get complete details, write Plastics Machinery Division, National Rubber Machinery Company, Akron 8, Ohio.

NATIONAL RUBBER MACHINERY CO. General Offices & Engineering Laboratories Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
AGENTS East: National Rubber Machinery Co., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
EXPORT Plastics Machinery: OMNI EXPORT CORPORATION
460 4th Ave., New York 16, N. Y.

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Creative Package Engineering

this corrugated dispenser box

Protects . . . identifies . . . displays . . . dispenses . . . sells . . . *cuts packaging costs.* This is creative package engineering—*package action.* Applied to YOUR product it will give you pronounced competitive advantages— complete protection, favorable attention, sales stimulation. Consult Hinde & Dauch, Executive Offices, 5001 Decatur St., Sandusky, Ohio.

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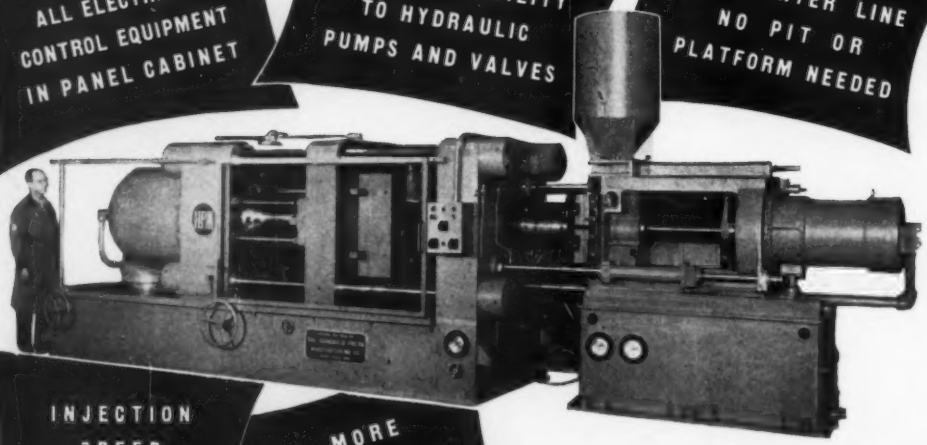
ALL ELECTRICAL CONTROL EQUIPMENT IN PANEL CABINET

EASY ACCESSIBILITY TO HYDRAULIC PUMPS AND VALVES

LOW CENTER LINE NO PIT OR PLATFORM NEEDED



INJECTION SPEED DOUBLED

50% MORE PLASTICIZING CAPACITY

DESIGNED FOR EASY CONVERSION TO 200 OZ. PRE-PLASTICIZING

H-P-M's NEW "60 OZ." INJECTION MOLDING MACHINE

THE LATEST "PROFIT-MAKER" FROM H-P-M, DESIGNED FOR TODAY'S MAXIMUM CAPACITIES

SPECIFICATIONS
H-P-M MODEL 1000-H-60A

Injection capacity (oz.)	60
Mold Clamp (tons)	1000
Mold space	40"x60"
Daylight	54"
Clamp travel	36"
Injection pressure (psi)	20,000
Plasticizing capacity (lbs./hr.)	300
Heat cylinder (K.W.)	48
Motor H.P.	100
Weight (lbs.)	105,000

All Material ratings based upon molding cellulose acetate.

H-P-M's "60A" is important news to every molder. Built-into this outstanding machine are features which provide easy conversion to larger injection capacities . . . up to 200 ounces! The H-P-M All-Hydraulic Mold Clamp is a distinct and separate unit . . . it's versatile . . . no need to buy a new mold clamp if you want bigger shot capacity later . . . just buy H-P-M's 200 ounce pre-plasticizing conversion unit when you're ready. Think what this means in reduced equipment investment! In addition, H-P-M's famous proven design, fast mold cycle, quick mold set-up, versatile application, dependable service are part and parcel of this new H-P-M machine.

Insure your position for new and future molding business by checking into the H-P-M "60A" today—it's the profitable thing to do.

Write for complete specifications.

H-P-M STOCK SIZES — 9, 16, 32, 60 & 200 oz. CAPACITIES

The H-P-M "60A" electrical control equipment including relays, timers, pyrometers are completely housed, and easily serviced in this panel cabinet.

Extra long torpedo for increased plasticizing capacity.

THE HYDRAULIC PRESS HPM MANUFACTURING COMPANY

1010 Marion Road Mount Gilead, Ohio U. S. A.

Magnet in a Major Market

Toys made with cellulose acetate are bright and gay, rich in color, and charming in their lifelike realism. Children and parents alike find them irresistible.

There's more, though, to the story of the popularity of acetate playthings than mere good looks and eye appeal. Both retailers and customers have learned that selecting acetate toys is their one best assurance of obtaining quality . . . quality, which like acetate's color, is through and through.

In store windows, and on counters everywhere, the finest plastic toys are acetate.

HERCULES POWDER COMPANY 916 Market St., Wilmington, Delaware

COLORFUL
LIGHTWEIGHT
DURABLE
STRONG
ECONOMICAL
SAFE

HERCULES
Cellulosic Plastics

CP50-8

CREATIVE CUSTOM MOLDING

The above illustration is an example of CRUVER'S versatility in custom molding.

CRUVER supplies the three plastic units for this attractive cash register illuminated sign. The sign was designed by Anheuser-Busch and is produced by Raymond M. Price and Associates of Chesterton, Indiana.

CRUVER

MANUFACTURING CO.

2460 W. JACKSON BLVD., CHICAGO 12, ILL.

BRANCH OFFICES

DETROIT MINNEAPOLIS NEW YORK

CLEVELAND ST. LOUIS

Watson-Standard laboratories have wide experience in the development of vinyl plastisols. These plastisols have been accepted in the vinyl molding industry.

The outstanding properties are ease of molding, permanent flexibility, good chemical resistance, color stability and durability.

MIGRATION

Independent Testing Laboratory reports Watson-Standard plastisols show no appreciable evidence of plasticizer migration.*

DECORATIVE LACQUERS

Decorative lacquers are now available as an additional service to the plastic molder. These lacquers are made specifically for adhesion to plastisols.

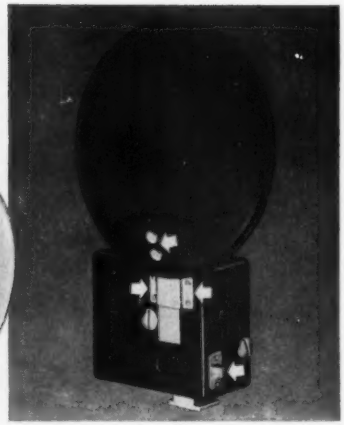
Let us help you with molding problems. Write today.

*Copy of laboratory report will be mailed on request.

Send for your copy of technical paper entitled "Slush Moldings." It's free!

THE WATSON-STANDARD CO.
225 Galveston Ave. Pittsburgh 30, Pa.

How to make PLANNED assembly savings PAY OFF



AVOIDS EXTRA OPERATIONS AND SPOILAGE R. A. Simerl Mfg. Co. avoids prohibitive costs in assembly of this Sims Flash Unit by using the simpler fastening method—with P-K Self-tapping Screws. They rejected riveting because of the extra equipment and extra step, peening, with consequent high rate of plastic fracture. Machine screws proved too costly because tapping was required, and the fastening security was unsatisfactory. Thirteen P-K Type U Screws fasten side cover, switch plate, name plates and other fittings to polystyrene case. Two P-K Type Z Screws (inside) fasten socket to case.

Here's another product *planned* for major savings with Self-tapping Screws, and assembled with savings *assured* by specifying Parker-Kalon.

Don't let screw failure cancel savings.

Once you have selected the most economical fastening method, it's common sense to get the best Self-tapping Screws money can buy. To assembly-wise manufacturers everywhere, that means P-K. Parker-Kalon originated Self-tapping Screws, learned long ago how to maintain the uniform quality, in every screw, that keeps assembly humming.

Let P-K* fit the fastener to the job

A P-K Assembly Engineer will help you fit the right fastener to your needs—not your needs to a certain type, because P-K makes a complete line. Find out why the makers of so many of the nation's best-known products say—"If it's P-K . . . it's O.K." Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y. Sold everywhere through accredited Distributors.

*TRADE MARKS REG. U. S. PAT. OFF.

Type U Drive Screw

Type Z (also made with Phillips Head)

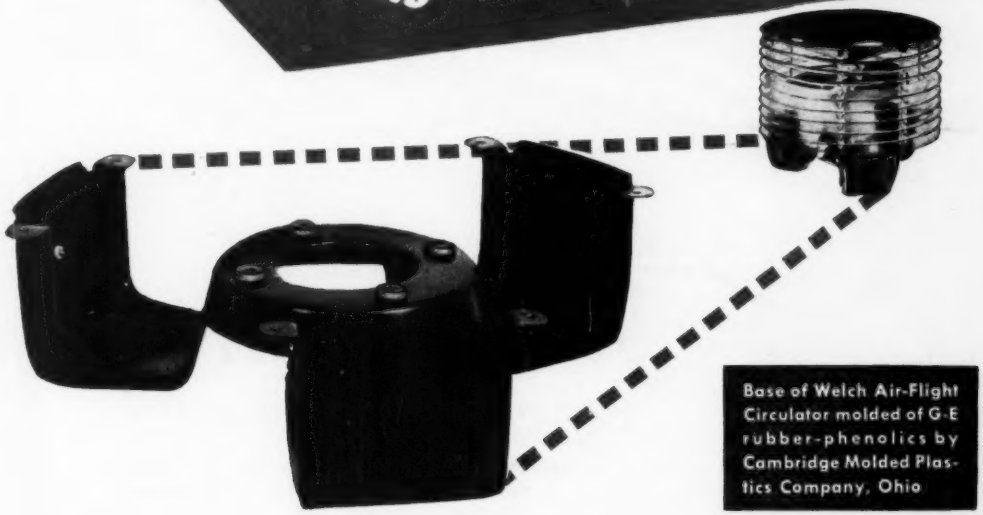
P-K TRADE MARK

The Original

PARKER-KALON* SELF-TAPPING SCREWS

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

G-E rubber-phenolics offer FIVE TIMES THE SHOCK RESISTANCE of conventional materials



Base of Welch Air-Flight Circulator molded of G-E rubber-phenolics by Cambridge Molded Plastics Company, Ohio

Here's a good example of how the use of General Electric rubber-phenolics compounds helped a molder to reduce costs and enabled his customer to produce a sturdy product of improved design and appearance.

Cambridge Molded Plastics Company molded the base of this circulating fan of G-E rubber-phenolics for the W. W. Welch Company. The molder reduced costs as a result of the easier molding and finishing characteristics of a wood-flour filled G-E rubber-phenolics compound, compared with the impact material previously used. The Welch Company was able to overcome breakage of the bases in shipping and in subsequent use, because of the shock resistance of the G-E material used.

In addition, the exceptional vibration and fatigue resistance which characterize G-E rubber-phenolics permitted the fan motors to be mounted directly on the base.

There's a whole family of G-E rubber-phenolics to choose from. Each has the characteristics of its filler plus shock resistance more than five times greater than ordinary phenolic compounds. The wood-flour filled type can be preformed and molded like general-purpose phenolics. Expensive hand cleaning is unnecessary because of the easy flash removal of these new materials.

Investigate this line of G-E rubber-phenolics! Try them in your own plant and see for yourself how they can help you make sturdier, better-looking parts. For more details, including data sheets and experimental samples, just write to Section D3, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

You can put your confidence in

GENERAL ELECTRIC

NEW PROPERTIES FOR YOUR PLASTIC LAMINATES
when you use Glass Cloth woven from
Vitron GLASS YARNS
Reinforce your plastics with industrial fabrics woven from VITRON Glass Yarns and gain these important properties:
TREMENDOUS STRENGTH—more strength for weight than most structural metals. High tensile, flexural, impact and compressive.
MOISTURE RESISTANCE—inorganic glass fibers themselves absorb no moisture; will not swell or shrink.
CORROSION RESISTANCE—glass fibers resist oxidation, mildew, oils and most acids.
HEAT RESISTANCE—Vitron Glass Fibers withstand temperatures of 1000° F; conduct heat away rapidly.
VITRON Glass Yarn fabrics for plastic reinforcing are woven and sold by leading industrial weavers. Our engineering staff is available to you on a moment's notice to help with any reinforcing problem. Write today for complete information.
You'll find VITRON in:
• electrical panel boards
• motor slot sticks
• television parts
• aircraft: radomes, wing tips, hot air ducts, window frames, engine cowlings and other parts
• varnished insulating cloth
• plastic pipe
• moisture-proof coated fabrics
Vitron®
GLASS FIBER
PLASTIC REINFORCING MATERIALS
GLASS FIBERS INC. • WATERVILLE, OHIO
PHONE: WATERVILLE 2201

"no more GAMBLING on tool steel selection"

[½ actual size; Selector is in 3 colors]

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group — Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!!

Since the first announcement, hundreds of tool steel users have received their CRUCIBLE TOOL STEEL SELECTORS. The comments received indicate that this handy method of *picking the right tool steel right from the start* is going over big.

"Handiest selector I've ever seen"

"No more gambling on tool steel selection"

"You're right, the application should dictate the choice of the tool steel" . . . and many, many more favorable comments.

You'll want your CRUCIBLE TOOL STEEL SELECTOR. It uses the only logical method of tool steel selection—begin with the application to pick the right steel! And the answer you get with one turn of the Selector dial will prove satisfactory in every case, for the CRUCIBLE TOOL STEEL SELECTOR covers 22 tool steels which fit 98% of all Tool Steel applications. ALL the tool steels on the Selector are in Warehouse Stock . . . that means when you get the answer, you can get the steel . . . fast!

Write for your Selector today! We want you to have it, because we know you've never seen anything that approaches your tool steel problems so simply and logically. Just fill out the coupon and mail. Act now! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

Crucible Steel Company of America
Dept. MO, Chrysler Building
New York 17, N. Y.

Gentlemen:

Sure! I want my CRUCIBLE TOOL STEEL SELECTOR!

Name_____ Title_____

Company_____

Street_____

City_____ State_____

CRUCIBLE first name in special purpose steels

TOOL STEELS

fifty years of Fine *steelmaking*

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DENVER • DETROIT HOUSTON, TEXAS • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

Proof that METASAP STEARATES MEAN BETTER MOLDING

Here's proof, in 3 pictures, that Metasap Stearates can help you do an excellent molding job:

Picture 1 shows a preform such as no molder wants. It was obtained during extensive tests run by the Watertown Manufacturing Company, and proved typical of a large number of preforms molded from compounds that did NOT contain Metasap Stearate as lubricant. Such preforms required an average pressure of 50 lbs. to eject them from the mold, and an unprofitably large percentage were delaminated in the ejection process.

Picture 2 shows a typical preform obtained, during the same tests, from molding compounds containing Metasap Calcium Stearate. Perfect in shape, such preforms required only 10 lbs. of pressure to release them from the mold.

Picture 3 shows how early in the manufacturing cycle the advantages of Metasap Stearates can be realized. In rolling sheets of molding compound (prior to grinding for powder) the inclusion of a Metasap Stearate aids in preventing the material sticking to the rolling mill.

Photos courtesy of Watertown Manufacturing Co., Watertown, Conn.

ADD IT ALL UP—and the answer is plain:

Lubricating with Metasap Stearates assures—

Improved Preforms—without delamination . . . since high ejection pressures are unnecessary.

Improved Finished Products—clean cut, with more marketable finish.

Increased Output—Rapid, easy ejection avoids waste of time and effort—assures fewer rejects.

Increased Economy—Preform molding can be done with machines of less tonnage. Molding materials are conserved. Mold life is increased—because scoring is virtually eliminated.

Metasap Zinc and Calcium Stearates, for use in molding plastics, assure significant manufacturing economies all along the line—and better products, too. Today, when you must produce *quality* and sell *competitively* you'll find Metasap stearate lubrication an indispensable aid to more profitable operation.

For complete information, write

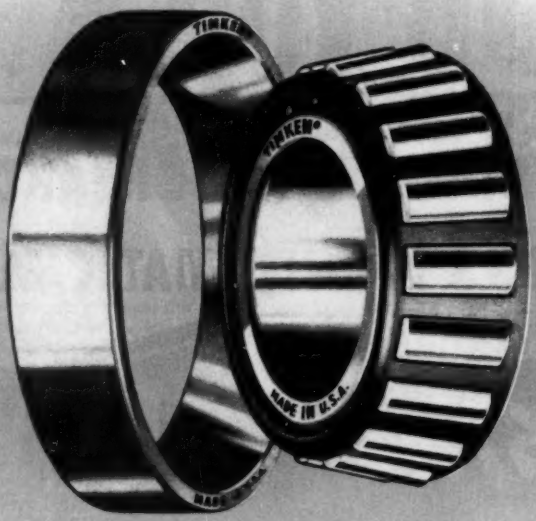
METASAP CHEMICAL COMPANY, HARRISON, N. J.

Chicago • Boston • Richmond, Calif. • Cedartown, Ga.

METASAP CHEMICAL COMPANY REG. U.S. PAT. OFF.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc



NOT JUST A BALL

NOT JUST A ROLLER

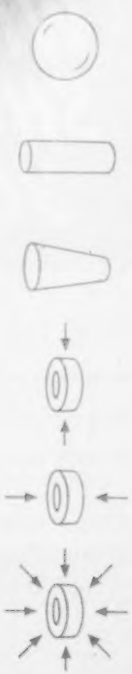
TIMKEN TAPERED ROLLER

TRADE-MARK REG. U. S. PAT. OFF.

BEARINGS TAKE RADIAL

AND THRUST LOADS

OR ANY COMBINATION



THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

Do You Know

WHAT CAUSES BREAKDOWNS... REJECTIONS IN AUTOMATIC MACHINES?

Fastax High-Speed Motion Picture Studies Have Been Made of:

- Machine Shop Tools Working.
- Failure of Rapidly Moving Mechanisms.
- Faulty Design Problems such as shattering relay contacts and cams.
- Gas and Liquid Flow . . . Combustion.
- High-Speed Weaving and Spinning Operations.
- Mechanical, Electrical, Physical and Anatomical Reflexes and Vibrations.
- Other applications too numerous to mention.

WRITE for catalog and information on how Wollensak can equip a high-speed laboratory for you . . . Completely portable and easy to use. Wollensak Optical Co., 803 Hudson Avenue, Rochester 21, N. Y.

Wollensak OPTICAL CO., ROCHESTER 21, N.Y.
MEANS FINE LENSES

Now! SPEEDY PRODUCTION OF POLYESTER LAMINATES

with

DRYPLY

THE COMPLETE POLYESTER LAMINATING MATERIAL

LOW PRESSURE LAMINATING MADE EASY WITH DRYPLY

The simplicity of operations with Dryply has opened new doors in polyester low pressure laminating. Now, production speed and production economy can be attained without any noticeable revisions in present manufacturing setups. This new reinforced material elevates the low pressure field to equal other mass production methods. Cured parts can now be formed at as fast a rate as 15 seconds.

RESIN CONTENT CONTROLLED

Quality finished parts are assured, as Dryply resin content is rigidly controlled by a continuous mechanical impregnating process. Messy, inefficient, wet lay-up is eliminated. Dryply comes to you ready-to-use in a dry state with catalyst already added.

NO WASTE WITH DRYPLY

Dryply comes in ready-to-form rolls. . . . No liner. . . . Unrolls like a roll of paper. You just cut your patterns to desired size and thickness and store left-over pieces for future use. Remember, Dryply can be stored for six months or longer under normal room temperature.

HERE'S WHAT DRYPLY SAVES YOU

You save TIME through speed of application. . . . You save LABOR because there are fewer operations and unskilled personnel can do the job. . . . You save MATERIAL since there is no waste.

DRYPLY is used in forming by:

(a) Male and Female Molds
(c) Pressure Bag Forming
(b) Cellophane Wrap
(d) Vacuum Bag Forming

Ready to Form

Right Off the Roll

Nothing to Add

Wet Lay-Ups Eliminated

DRYPLY has many uses for many industries

AIRPLANE AUTOMOBILE

REFRIGERATION AIR CONDITIONING

TELEVISION RADIO TOY

BOAT ELECTRICAL PACKAGING

also Prototypes and Models

CHECK THE QUALITIES OF DRYPLY FOR YOUR PRODUCT

Dryply has proven to be extremely versatile. Day by day, new uses are discovered and its application is becoming widespread in a variety of industries. We invite you to learn all about Dryply.

ABC operations with DRYPLY

A — Cut Material
B — Place on Form
C — Cure Under Heat and Pressure

DRYPLY NOW AVAILABLE IN BOTH GLASS MAT AND CLOTH

DRYPLY Shelf Life
6 MONTHS
OR LONGER
At Normal Room Temperature

Flexfirm PRODUCTS
POLYESTER DIVISION
2300 No. Chico Ave. El Monte, Calif.
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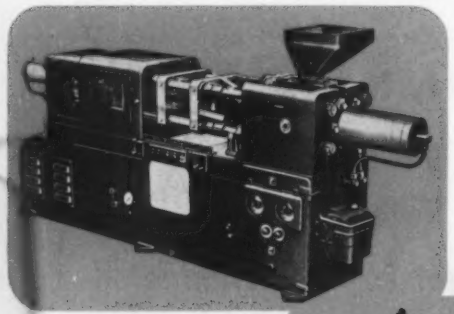
Windsor's

Famous for—INJECTION MOLDING MACHINES



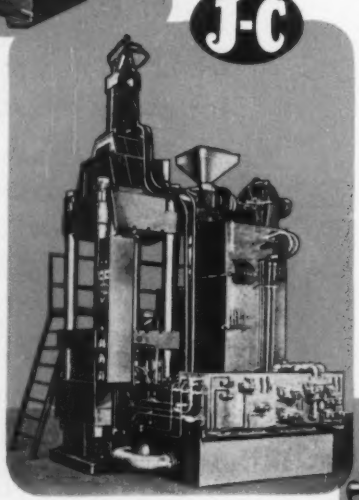
The S•H•4
AUTOMATIC CONTROLLED CYCLE INJECTION MOLDING MACHINE

Designed to provide a medium capacity machine capable of producing articles weighing up to 4 ounces per shot, in a wide range of plastic materials.

The J•C
UNIVERSAL MOLDING PRESS

FOR INJECTION, EXTRUSION AND COMPRESSION MOLDING IN 48, 60 AND 80 OUNCES

20-50% faster cycles. Lower injection pressures. Greater projection areas.



PROGRESS AND DEVELOPMENT

R. H. Windsor Ltd., are considered the world's largest producers of machines for the thermoplastics industry and have developed injection molding and extrusion machines which embody the latest operating, production and safety features consistent with the most advanced trends in plastic molding and extrusion technique. These facts, together with the manufacturing of injection molds, extrusion dies and ancillary equipment, represent a complete service to customers world-wide.

Important and extensive additions have recently been made, both in factory space, machinery and equipment, to keep pace with the growing demand for our machines in the world markets.

"Windsor's" have the sole manufacturing and distributing rights for the well-known L.M.P. Multi-Screw Extrusion Machines for the British Commonwealth, Dominions and Colonies, United States of America, South America (excluding Brazil), and the sole manufacturing and distributing rights of the Jackson & Church "Hendry" Pre-plasticising Press for the British Commonwealth, Dominions and Colonies, Europe and the Argentine. The acquisition of the rights of these two types of machines for the plastics industry, represents the most important progress made in the industry in recent years.

The S•H•8/10
INJECTION MOLDING MACHINE

Capable of producing articles weighing up to 10 ounces per shot, in a wide range of plastic materials.

INJECTION MOLDING MACHINES

"Windsor's" injection molding machines are of robust construction and manufactured from the highest quality materials, specially designed to withstand the heavy loads to which the machines are subjected.

The machines of 4-oz. and over are equipped with automatic cycle control, ensuring correct timing of the molding operation. Hand-control can be used if necessary for special purposes.

The tie bars of the machines are of a special alloy steel, hard-chromed and accurately ground to ensure long life and alignment. A special feature incorporated in our new S.H. 8/10-oz. machine and the S.H.16/20-oz. machine is the hydraulically-operated retractable injection unit. A valve from the main circuit operates the retracting cylinders to bring the nozzle against the sprue bush or away from the mold for sprue clearance or changing of material cylinders.

A further feature of our new S.H.8/10-oz. machine is that the injection speed of the hydraulic piston is infinitely variable from zero to maximum by output control of pump on actual effective stroke water-cooled plunger.

Safety guards are fitted to each machine preventing the press from operating when the guards are open.

The material cylinders are of special high grade alloy steels, and are carefully designed and thoroughly tested to ensure uniform heating and an adequate amount of heated material. The cylinders are fitted with band heaters, internal and nozzle heaters, all of which are controlled by means of thermometers with thermostat control or pyrometers.

In the larger capacity models, the main outstanding feature of the Jackson & Church "Hendry" Pre-Plasticising Ma-

HAVE THE REPUTATION OF PRODUCING TO-DAY THE MACHINES OF TO-MORROW FOR THE PLASTICS INDUSTRY

And the latest—EXTRUSION MACHINES

chine is that thermoplastic material is plasticised before it reaches the injection chamber. It is essentially a combination of an extruder pump which uniformly heats and completely plasticises the molding material and then forces it into an injection chamber which is different from the conventional design by not having spreaders or torpedoes. From this feature one of the main advantages of the machine can be seen . . . by reducing the high pressures which are conventionally used, completely strain-free moldings are ensured.

A RANGE OF INJECTION MOLDING AND EXTRUSION MACHINES

Our injection molding machines range from .35-ozs. to 80-ozs. capacity. The machines from .35-ozs. up to 3-ozs. are hand-operated and semi-hydraulic. Our S.H.3-oz. capacity machine is self-contained and fully hydraulically operated. Our S.H.4-oz., S.H.6/8-oz., S.H.8/10-oz., and S.H.16/20-oz., are self-contained fully hydraulic automatically controlled cycle and/or hand-operated machines. The U.H.M.48-oz., U.H.M.60-oz., and U.H.M.80-oz. capacity machines are built under the Jackson & Church "Hendry" Pre-Plasticising process.

In the range of extrusion machines, we have the S.35 3½" Single-Screw Extruder (available in Europe only) and the Multi-Screw Extrusion Machines built under the "L.M.P." principles in R.C.65-lb., R.C.100-lb. and R.C.200-lb. capacities respectively. The Multi-Screw Extrusion Machines are well-known for their efficient compounding, mixing and uniform extruding qualities.

R. H. Windsor Ltd., are prepared to give, without any obligation, unbiased advice on machinery, equipment, molding or extrusion problems, based on intimate knowledge of the plastics industry.

MOLDS, DIES AND ANCILLARY EQUIPMENT FOR INJECTION AND EXTRUSION

We are specialists in the design and manufacture of molds and dies of all types in the plastics industry. Our staff consists of experts in tool-making in all its branches, and our machines the most advanced for this class of work. Our newly-formed Extrusion Development Research Department is at your service to advise on the technical problems of today and the future, particularly in extrusion dies and special ancillary equipment.

OVERSEAS AGENTS

We are represented by some 50 agents in the world's markets. These agents are well-known in the plastics industry for their long-standing and intimate knowledge of the industry. All agents have their technical personnel who are fully backed up by Windsor's overseas maintenance engineers, which ensures best service to the customers. India, Pakistan and Ceylon are covered by the newly-formed R. H. Windsor (India) Ltd. Situated in Bombay, this company is staffed by experts in the plastics industry and service engineers trained at our factory.

R•C-65
THE NEW TWIN SCREWS
R•C-65 and R•C-100
EXTRUSION MACHINES
• compounding
• coloring
• plasticizing
• scrap reclaiming
Low operating and power costs. Produces from .010" monofilaments to 10" tubes, strips and special sections. Built to American Standards of Performance.
R•C-100

LMP PLASTIC MACHINES

R. H. Windsor Ltd.
16 FINSBURY SQUARE LONDON E.C.2
ENGLAND

Phone MONarch 8722 • Grams TECHNIMACH FINSQUARE LONDON • Cables TECHNIMACH, LONDON

Card design© American Greeting Publishers, Inc., Cleveland, Ohio

High Vacuum

is styling Christmas cards this season

• If you see a metallic glint on St. Nick's whiskers this Christmas, the effect probably comes from a wonderful basic new material—cellulose acetate coated with a thin deposit of metal. Variations of it are stimulating both the ingenuity and the sales of fabricators who want an expensive look at low cost.

In this particular case, Santa's whiskers are die-cut from sheeting aluminized in long rolls under high vacuum. The same process, applied to one or both sides, is responsible for the metallic gleam of many materials for packaging, interior decoration, merchandising displays—even sequins to suit the whims of fashion.

The electronics industry deposits metal on tissue in DPi Roll Coaters to make small condensers by the millions. Fighting men wear clothing made from infrared-reflecting cloth to reduce radiation loss from the body. New applications are being developed constantly.

High vacuum serves in many other ways too—in flash distillation of plasticizers, in impregnation of fabrics, in dehydration, in producing new metals, in imparting new properties to familiar metals. As builders of equipment which makes high vacuum a practical, economical production tool, DPi invites your inquiries. Write to Vacuum Equipment Department, ***Distillation Products Industries,*** 779 Ridge Road West, Rochester 3, N. Y. (Division of Eastman Kodak Company)

high vacuum research and engineering

DPi

Also . . . vitamins A and E . . . distilled monoglycerides . . . more than 3300 Eastman Organic Chemicals for science and industry.

CUSTOMERS RE-ORDER with confidence from NORTON

Customer: Richard Hudnut

WHEN A CUSTOMER keeps coming back to a supplier, it's a sure sign he's been pleased with the previous treatment he's received. . . . That's what happened with Richard Hudnut.

Back in 1941, Norton first molded a family of attractive plastic containers for Hudnut's DuBarry cosmetics. And through the years, Norton has filled order after order for these containers.

. . . Now, in 1950, Norton is still supplying molded containers for Richard Hudnut. This time, three in number . . . two flat boxes for the DuBarry line and a Courtley shaving mug.

Like others of our satisfied customers, Richard Hudnut likes Norton's sound engineering, cooperative service, flawless molding, sensible pricing and dependable deliveries.

Norton is interested in cultivating *your* molding business. Ask for a free survey of your next molding assignment by a Norton engineer from our nearest sales office. Write today. Norton Laboratories, Inc., Lockport, N. Y. Sales Offices: *New York—347 Fifth Avenue; Chicago —5221 Kimbark Avenue.*

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING

NYLON KNOW-HOW

Cut-a-way view of the "ACROPAK" shuttle bobbin manufactured by Acrometal Products, Inc., Minneapolis, Minn. showing NYLON edge rims and NYLON bearings.

OUR EXPERIENCE-- YOUR GAIN

NYLON with its unusual properties is opening new fields in industry.

An example of an interesting problem which worked out to a successful conclusion is illustrated on this page. Shuttle bobbins, furnished to the textile industry by Acrometal Products, Inc., carry edge rims and bearings of injection molded NYLON. The parts are held to extremely close tolerances and are designed to withstand the rigors of tough industrial usage.

Early experience with this molding compound places us in the enviable position of having "NYLON KNOW-HOW"!

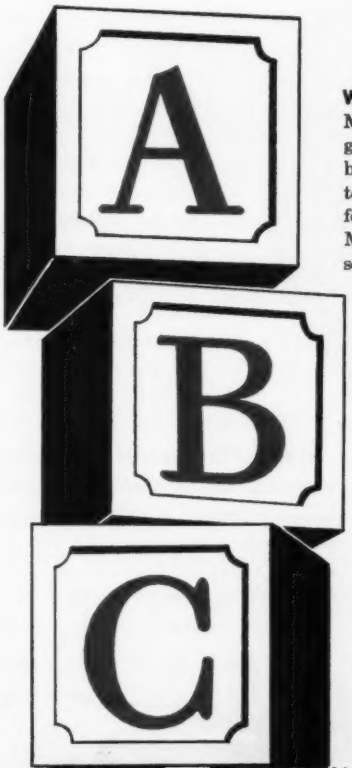
Will injection molded NYLON solve your problem? We invite your inquiry.

INJECTION MOLDING
MINCOR
YOUR PLASTICS DEPARTMENT

MINNESOTA PLASTICS CORP.
366 WACOUTA • ST. PAUL 1, MINN.

FREE technical service solves vinyl plasticizer problems as easy as . . .

There's no need to wrestle with vinyl plasticizer problems when you are developing a new product or working on improvements in your present line. Call upon Monsanto's plasticizer specialists. Let them help you solve your problems. It's as easy for you as A B C!



WRITE, WIRE, PHONE. Tell us your problem and Monsanto's fully equipped application laboratory will go to work for you. We will save you initial research by recommending a *proved* formulation, or our technical service staff will develop a custom-made formulation for you. If you wish, and if necessary, a Monsanto specialist will work in your plant. All of this service is yours without cost . . . without obligation.

WORLD'S MOST COMPLETE LINE! The family of Monsanto Santicizers is unmatched anywhere. With this *complete* line at their command, our plasticizer technicians can recommend exactly the plasticizer or combination of plasticizers *you* need.

YOUR PROBLEM SOLVED, giving you the advantages of lowered costs, more efficient processing or improved products. For further information on this *confidential* service to users of plasticizers, mail the coupon or get in touch with the nearest Monsanto Sales Office. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1707-L South Second Street, St. Louis 4, Missouri.

Santicizer: Reg. U. S. Pat. Off.

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Details on the world's most complete line of vinyl plasticizers, plus technical information of value to plastics manufacturers, are yours in the 80-page book, "Monsanto Plasticizers." Mail the coupon today for your *free* copy.

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
1707-L South Second Street, St. Louis 4, Missouri

Without cost or obligation to me or my company, please send:
. . . . . Monsanto representative to discuss our problem; . . . . . information on Monsanto Technical Service; . . . . . book, "Monsanto Plasticizers."

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Company . . . . .
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City . . . . . *Zone* . . . . . *State* . . . . .

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Will Corrosion Resistance + "X"

SYNTHANE plastic laminates have helped many manufacturers solve corrosion problems. Corrosive compounds, gases, various water compositions, moisture, oils, and gasoline have little, and often no, adverse effect upon Synthane. But corrosion resistance is only one of many other Synthane advantages abbreviated to the "X" above.

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SYNTHANE

AT WORK IN INDUSTRY

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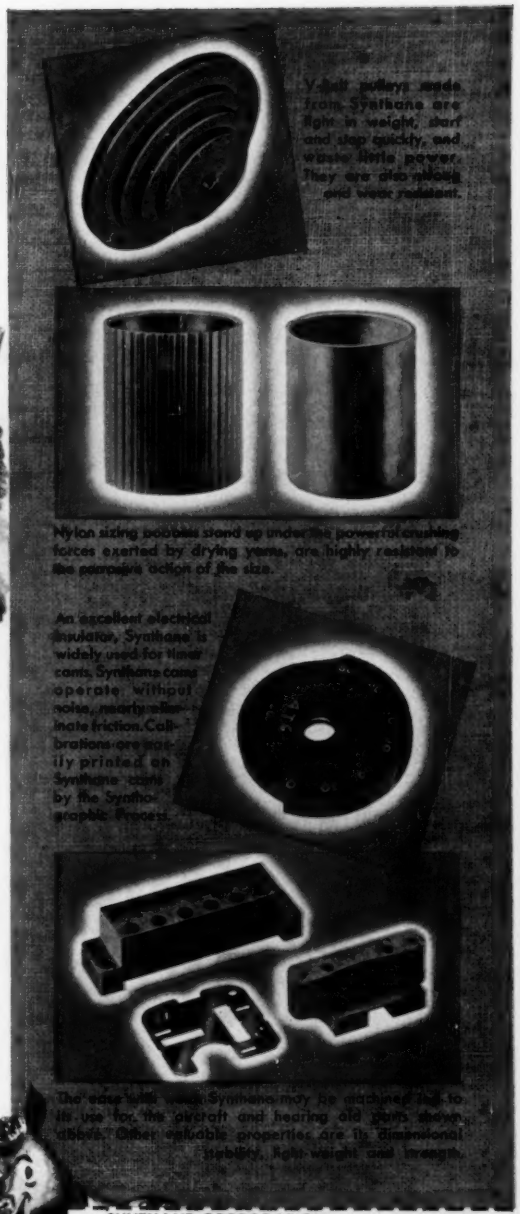

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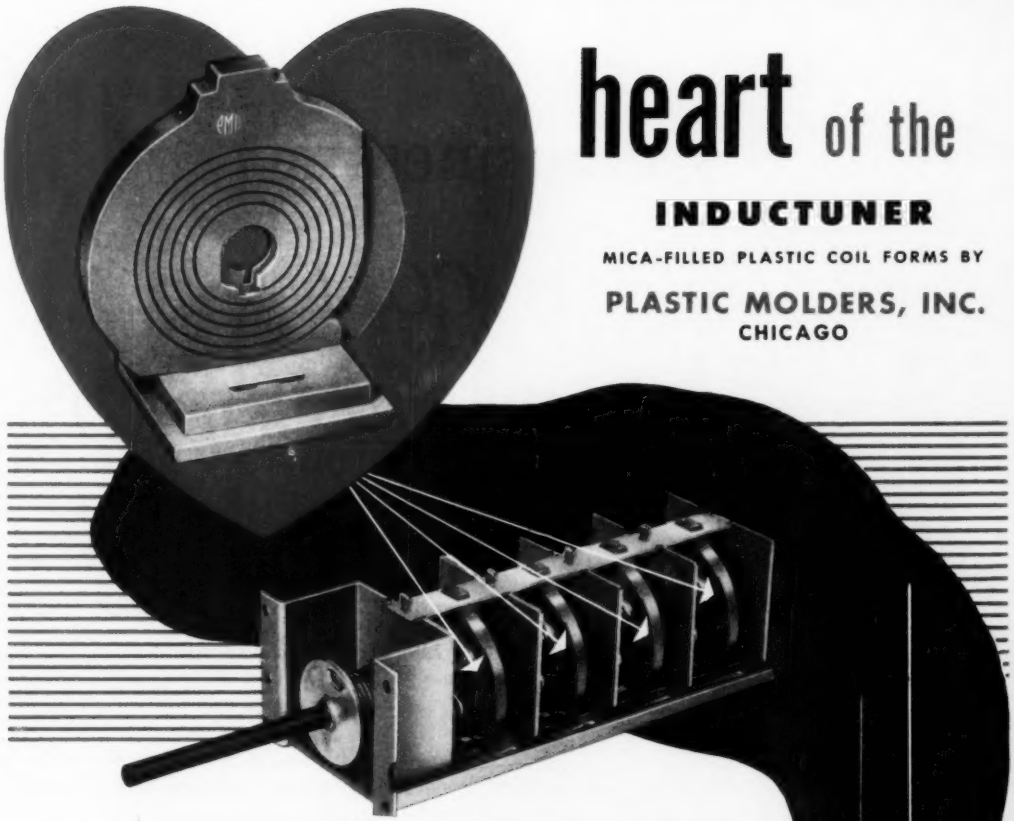

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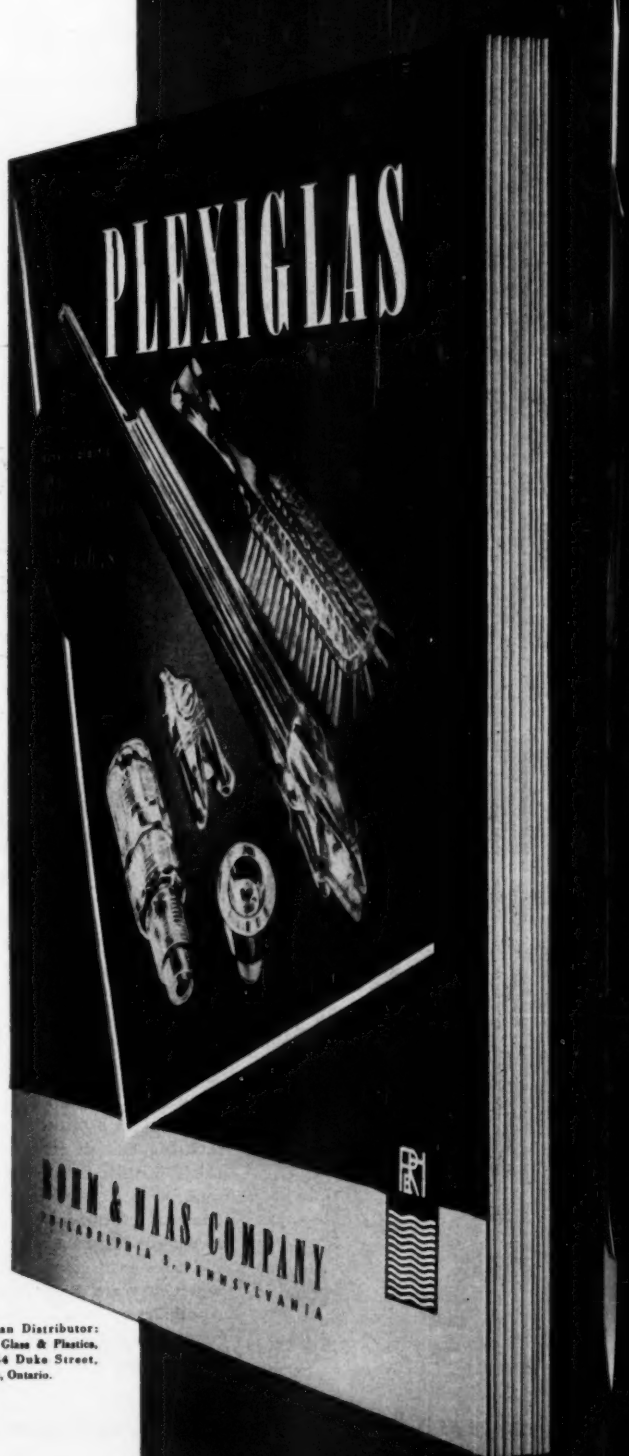

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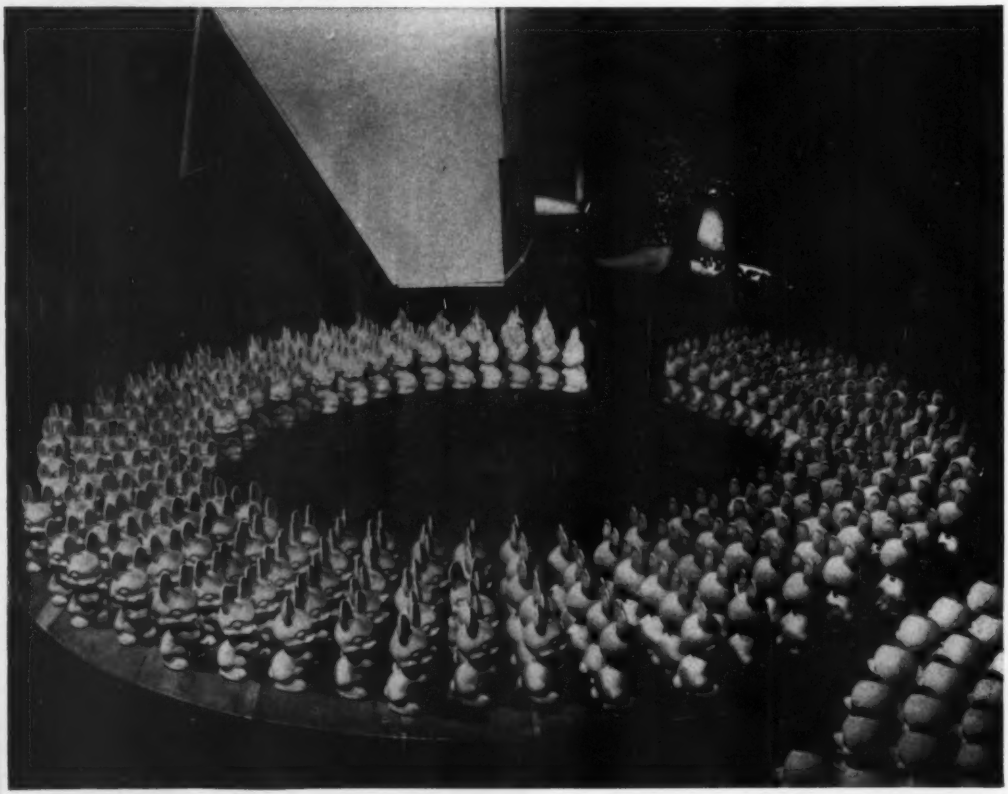

Photo courtesy of Rempel Mfg., Inc., Akron, Ohio

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Aico plastics go underground

Photo courtesy DuPont Magazine

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MODERN PLASTICS

VOLUME 28 NOVEMBER 1950 NUMBER 3

Added Beauty for Molded Plastics

New and improved techniques of decoration are being used more and more often to give molded plastic items greater sales appeal or utility

A FAST-GROWING variety of molded plastics products are now being decorated, either during or after molding. As a result, with new and improved techniques of decoration available, many molded items are now given sales appeal or functional features which solid-colored molded items cannot have.

As the following survey indicates, there is a wide variety of decorating methods available to molders of plastics. The method to be used in any given case will depend upon the molding material used, the shape of the molded item, the quantity in which it is to be produced, its price range, and, of course, the type of decoration desired. For molders or end users, the first step in choosing a method for any particular product is to become familiar with the methods which are available.

COURTESY TENNESSEE EASTMAN CORP.

New Underwood typewriter has keys double molded of butyrate by Electric Mfg. Co., Auburn Button Works

Decorating While Molding

Among the various methods of decorating plastics during the molding operation, the oldest and most commonly used is so simple that it can hardly be classified as a method of decorating. It consists simply of molding the item of two or more colors which are only partially mixed together. The result is a marbelized effect which is more desirable in certain types of items than a solid color.

A recent improvement in this type of decoration has been made by some molders who have learned how to control the flow of the materials so as to produce a straight simulated wood grain instead of a marbelized effect. By carefully selecting the colors to be used, these molders can produce surfaces which closely resemble mahogany, maple, walnut, or other woods.

Two-color injection molding—A process for molding two colors into a single piece was first developed before World War II by Gits Molding Corp., Chicago, Ill. The patented process consists of a two-shot technique in which the piece molded first is used as an insert in the mold during the second shot.[1] Among the recent improvements in two-shot molding technique is the development of a special machine to do the

[1] For a description of the Gits process, see "Multiple-Shot Molded Parts," MODERN PLASTICS 25, 129 (Apr. 1948).

Wood pulp and phenolic tray made by Keyes Fibre (right) has Currier & Ives on molded-in paper

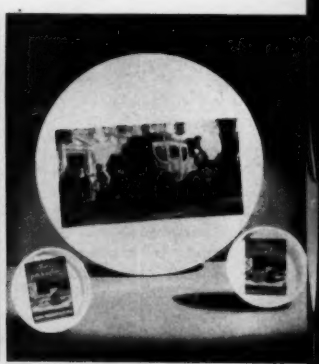
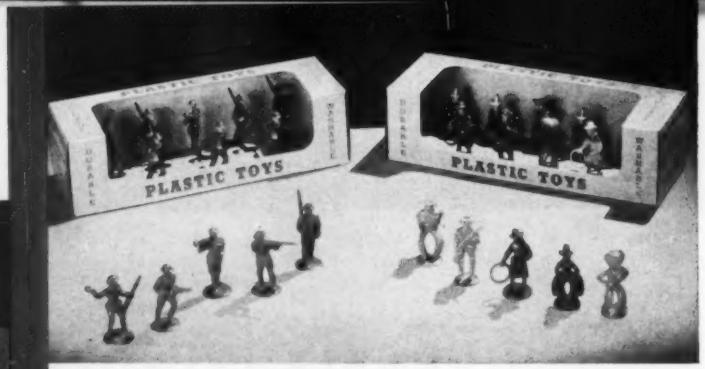


Plate and ad specialty coasters (far right) are decorated by transfer during the molding operation by Columbia Protektosite Co., Inc.

Cellulose acetate toy soldiers, cowboys, etc. (right) have hand painted features, clothing, etc.



COURTESY TENNESSEE EASTMAN CORP.

Pins molded of acetate (left) are hand painted in brilliant colors of fish, fowl, and hunting dogs

Acetate model of Palamino horse is molded in cream color, then lacquered and shaded free hand

COURTESY UTILITY PLASTICS INC.

Styrene box has Chinese scene molded-in in deep relief, is antiqued by spraying and wiping off

job. The machine, built by The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, is used to produce key tops for Friden calculators.[2]

Although there have been some other applications, such as two-color horn buttons and other emblems for the 1948 Hudson[3], the main use for the two-color technique to date has been in the production of key tops for typewriters and adding machines.

Molded-in printed decorations.—A production method of applying multi-colored decorations to melamine and urea surfaces during the molding operation was developed about two years ago by Molded Decorations, Inc., Newark, N. J.[3]

The method makes use of a membrane which is put into the mold along with the molding material. The membrane bears the design in an intermediate stage, and the chemicals and dyes in it are transformed to the final colors as the molded piece is cured. The design thus becomes an integral part of the molded piece and cannot peel or wash off.

Molded Decorations is currently producing urea trays, plates, and tid-bit servers decorated in full color with this process. The company is also producing restaurant or hotel serving plates molded of Melmac and decorated with a monogram and a colored border. In addition, the company is investigating the feasibility of producing the printed membranes for other molders to use, and nine molders are experimenting with such membranes.

A similar method has been developed by Keyes Fibre Co., Waterville, Me., for use in the production of

2 "Automatic Two-Color Molding," by R. J. Reinholts, MODERN PLASTICS 27, 96 (Feb. 1950).
3 "Decorations Applied When Molding," MODERN PLASTICS 25, 80 (Aug. 1948).

decorated Kys-ite trays. In the Keyes method, the photograph or print is on paper and is introduced into the mold with a molded preform of the tray. The preform is made of wood pulp and phenolic resin, and the printed paper is placed on top of it, sandwiched between two pieces of resin-treated paper which become transparent when molded.

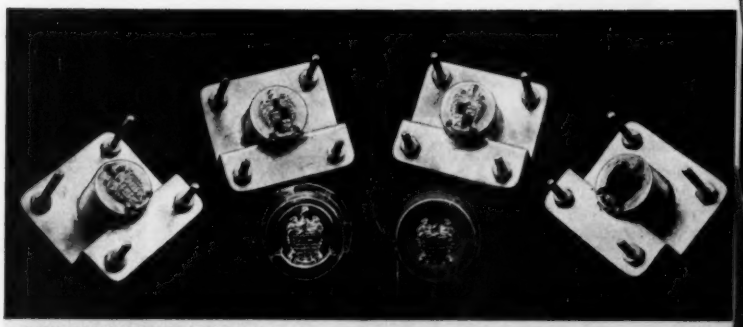
Another similar decorating process, developed and patented in Switzerland, is reported to be suitable for decorating melamine tableware, including pieces with deep draws such as bowls and cups. This method, known as the Hebrala process, involves the use of a molded preform and a printed impregnated paper which is also preformed. A number of molders are said to be experimenting with the process, according to Hudson Randall International, New York, N. Y., which represents the patent holder in this country.

Transfer while molding—The latest development in methods of decorating plastic items during the molding operation is a process recently announced by Columbia Protektosite Co., Inc. Carlstadt, N. J. It is claimed that the new process makes it possible to print on thermoplastic items during the molding operation with the same precision and accuracy obtained by printers using letter press or lithography. In addition, the printed designs are firmly embedded into the plastic and baked in rather than merely laid on the surface.

Until pending patents are granted, the company will not reveal the details of the method, except to say that it involves a transfer method of printing and that special inks and special molds are used. The process is said to be applicable to regular or irregular surfaces on any size piece which can be injection molded.

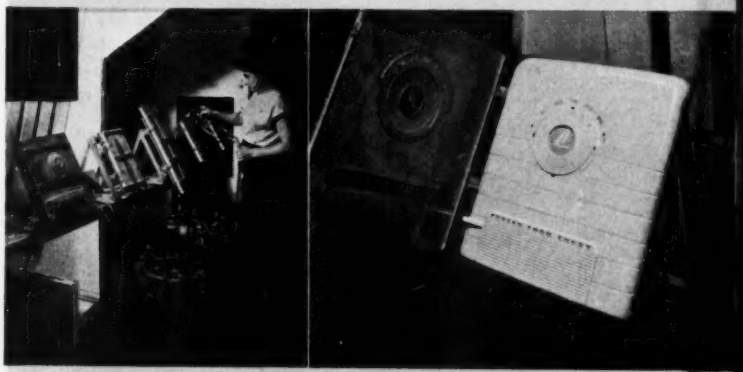
Painting and Spraying

Hand painting—In the search for methods of decorating plastic pieces after they have been molded, virtually all methods of printing on paper or of decorating other materials have been tried. Even the most ancient method of decoration, hand painting, has been found suitable for some plastic items. This method is most often used to dress

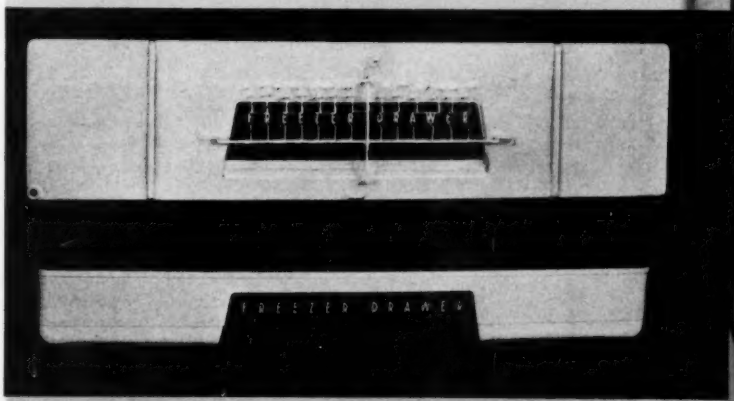


PHOTOS ON THIS PAGE COURTESY THIERICA STUDIO

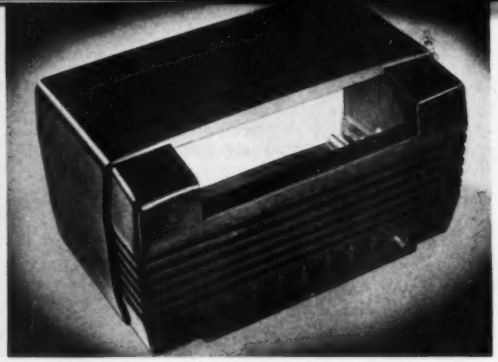
Door release button produced by Electric Auto-Lite Co. for Frazer car is molded of clear acrylic, then masked and sprayed in four colors with masks shown



Refrigerator parts molded by Nash-Kelvinator Corp. are masked and sprayed. Different parts to be sprayed with same color are mounted in the same booth



Admiral refrigerator freezer drawer has lettering sprayed on. The mask used (shown above the part) is an example of intricate bridging to mask isolated areas



1

2

Offset process used for reproducing a wood grain or leather texture involves three coats. Surface is first sprayed (1) with a specially formulated base or ground coat (2). Flat metal plate on which the design has been etched is then inked (3) and the design is lifted from the plate with composition roller (4) and applied to the plastic (5). Application of a clear protective topcoat is last step. Each coat is baked or air dried. Finished job is shown in photo 6

up solid-colored items to give them needed sales appeal or enable them to invade a higher price bracket. In such items, the hand applied decoration is not an essential part of the product.

There are, however, some products in which necessary decorations are applied by hand painting, even in long production runs. One example is found in the 3-in. high soldiers, cowboys, and other figures molded of cellulose acetate by Plastic Toys Corp., Byesville, Ohio. Facial features and black weapons are painted on the khaki-colored soldiers. Facial features and gaily colored clothes are painted on the western figures.

Another use is made of hand painting for decorating small items in the Wildlife Miniatures molded of acetate by Tri-State Plastics, Inc., Chicago, Ill. These pins, molded in the form of game fish, birds, and hunting dogs are hand painted in brilliant natural colors. From four to eight shades are used on each item. A 10½-in. high Palamino horse molded of acetate by Hartland Plastics, Inc., Hartland, Wis., is also decorated by hand. Special lacquers are air brushed on over a basic cream color, then finished and shaded with a free hand operation.

A similar shading effect is often used over molded-in designs to give molded plastic items an antiqued effect. An early example of this technique was the three-drawer Chinese chest produced by Amos Molded Plastics, Edinburg, Ind.[4] A more recent example is a box molded by Plastic Molded Arts, Inc., Long Island City, N. Y., for Utility Plastics Inc., Brooklyn, N. Y.

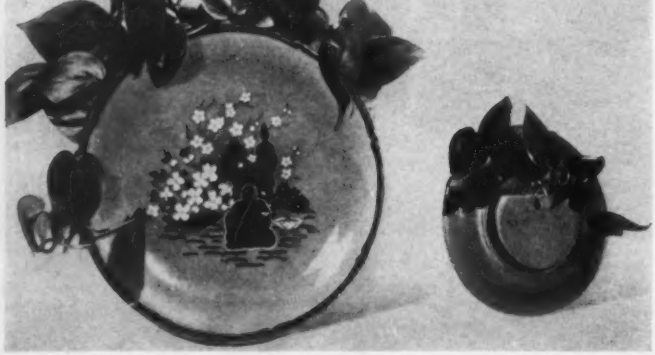
Spraying with masks.[5]—Despite its continued use for some applications, hand painting lacks the speed and uniformity which are necessary for many decorating jobs. This accounts for the continually expanding use of electroformed masks or stencils which cover all of the molded piece except the areas to be sprayed.

The use of such masks speeds up production, eliminates the need for skilled labor, and cuts the reject rate sharply. This often makes possible decorating jobs which would be uneconomical with conventional hand painting. And with the masks, absolute uniformity is assured throughout the production run.

Masks for spray painting are made

Wall plaque ivy pot molded of styrene has half-tone illustration applied to front surface by patented offset printing process developed by Anigraphic

COURTESY JAYDON, INC.



[4] "A Chinese Chest," by J. C. Kazimier, MODERN PLASTICS 25, 93 (Nov. 1947).

[5] The information on spray decorating was assembled from data supplied by the following companies which specialize in the production of spray masks: William Fiore, Inc., New York, N. Y.; Conforming Matrix Corp., Toledo, Ohio; Thierica Studio, Grand Rapids, Mich.

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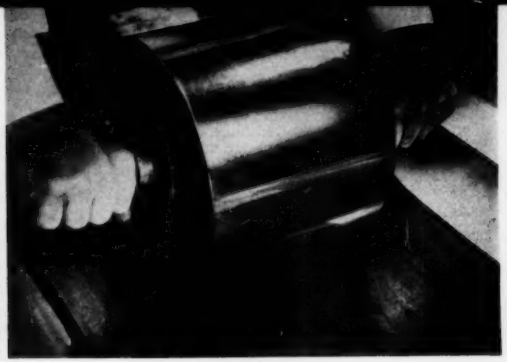

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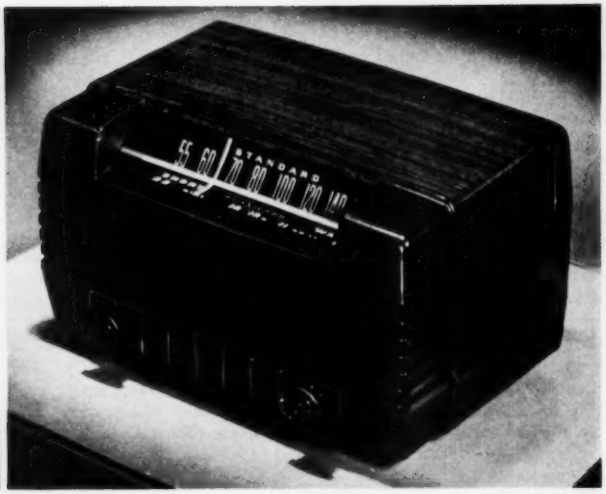


6

by electroforming a metal shell onto an actual production sample of the piece and then cutting out the areas to be sprayed. The mask must be accurately made because a loose fit between the plastic part and the mask allows the paint or lacquer to seep in and fog the edges of the colored area. And after the mask is made, close tolerances must be held during molding so that the pieces will be uniform in size.

It is also important that all cavities in a multi-cavity mold be uniform. When they are not, it is sometimes necessary to make extra masks for the job. This not only involves the expense of extra masks, but the labor required to separate the various parts is expensive, and the necessity of doing so slows down production.

Virtually any part which can be withdrawn from a mold can be decorated with electroformed masks. However, the job of making the masks and decorating the pieces can be greatly simplified if the decorating problems are considered when the mold is designed. For example, small ridges molded-in to the piece where colors end can help produce a sharp division between colors.

There are various methods of using masks, and the choice of method in each case depends upon the size and shape of the plastic piece, the type of decoration, etc. For some jobs, the mask is mounted in the spray booth and the part is held against it. In other cases, the parts are mounted in plaster or wooden jigs and the stencil is held on top of the part for the short time necessary to spray the color. For large pieces, like the refrigerator parts shown in an accompanying photograph, book type stencils are used. The part is put inside the hinged mask which is then closed to mask the part.

For long runs, particularly on small pieces, masking and spraying can be done automatically on spe-

cial machines. One such machine, developed by Conforming Matrix Corp., Toledo, Ohio, can handle up to 3600 pieces per hour. Masks are mounted so that they are flush with the working table of the machine. A battery of eight spray guns is mounted below the mask, and they can be set so that the same amount of paint is sprayed on each part. This is said to save up to 50% of the paint which would be used in a hand-spraying operation.

Spray masks are most widely used for decorating horn buttons, emblems, and escutcheons molded of transparent acrylic or styrene. In such pieces, the design is molded-in to the rear surface and the spraying is done from the rear. Most such pieces involve a number of colors. A separate mask is used for each color, and the usual procedure is to paint the deepest areas first, the next greatest depth second, until required decoration is completed.

Spray masks are also used often for radio dials, clock faces, calibrated control knobs, and for many refrigerator parts as well as for decorating dolls, toy cars, and Christmas ornaments.

Offset Printing

A number of methods for decorating plastics have been developed which utilize the offset principle. One such method, developed and patented by Anigraphic Process, Inc., New York, N. Y., is applicable to both thermoset and thermoplastic materials. (The process is also used to decorate glass and metals.) Intricate patterns, including half-tones, can be reproduced, and as many as four colors can be applied at once to the plastic object with perfect registration.

In the Anigraphic process, a separate plate is made for each color. The special inks used are transferred from the inked plates to a revolving rubber mat which in turn transfers the ink to the plastic item. The process can be used to decorate plane, concave, convex, or irregular surfaces.

The chief use for the process has been for labelling urea vials, polyethylene bottles, and other plastic packages, but the process is applicable in many other fields. It has been used, for example, to turn the molded styrene backdrop for a religious statuette into a replica of a stained glass window. A halftone illustration was reproduced on a styrene plate for another recent application, a combination ivy pot and wall plaque made by Jaydon, Inc., New York, N. Y.

For a grain or texture—Another offset process is useful for reproducing a wood grain or textured pattern on flat or some curved surfaces. The process is being used by Jeavons Japanning Co., Cleveland, Ohio; Parker-Wolverine Div., The Udylite Corp., Detroit, Mich.; and others.

The design or texture is first etched on a flat metal plate. The etched plate is then inked with a specially formulated ink and the design is lifted from the inked plate with a composition roller. It is then transferred onto the surface to be decorated, which has previously been covered by dipping or spraying with a base coat or ground coat specially formulated for the material to be decorated. This ground coat may be a lacquer or may have an alkyd or phenolic resin base.

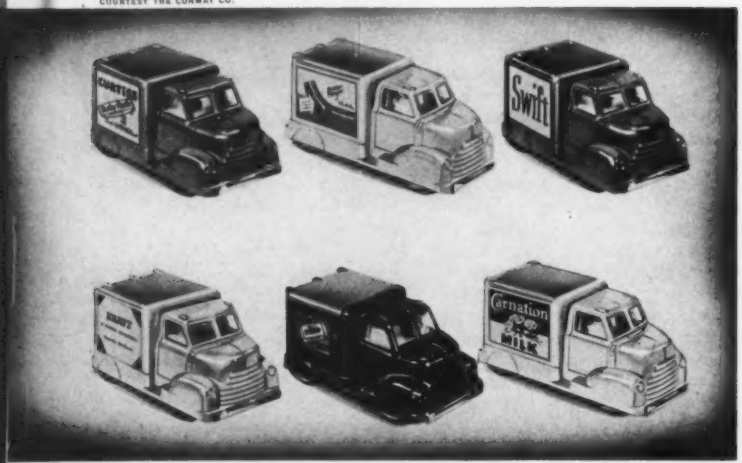
The application of the design with the composition roller can be done either by hand or with automatic machinery, depending upon the size and shape of the piece, the length of the production run, etc. After the ground coat has been grained, a clear protective topcoat is applied. Each coat (ground coat, graining, and topcoat) is either baked or air dried.

According to Jeavons Japanning Co., the process has been applied by that company to Philco and RCA radio cabinets. Parker-Wolverine reports that it has decorated other RCA radios, a General Electric clock radio, and some Admiral radios by this offset process.

The manner in which a wood grain is applied by this process to a molded plastic cabinet is illustrated in photographs on pages 74 and 75.

Toy trucks of various types are produced from same mold by simple expedient of varying color of acetate used and applying different decal decorations

COURTESY THE CONWAY CO.



Other Methods

Decalcomanias—Standard water-applied decals made by offset lithography can be used to decorate molded plastic items. However, they must be applied with chemical adhesives which must first be applied to the plastic itself. Each plastic material requires a different application procedure. Some materials, such as cellulose acetate, pose particular problems of adhesion or of plasticizer migration.

As a result, The Meyercord Co., Chicago, Ill., one of the country's largest manufacturers of decals, has developed two new types of transfers specifically designed for use on plastics. One type, known as Plasticals, will adhere to most plastics

(*Continued on p.* 173)

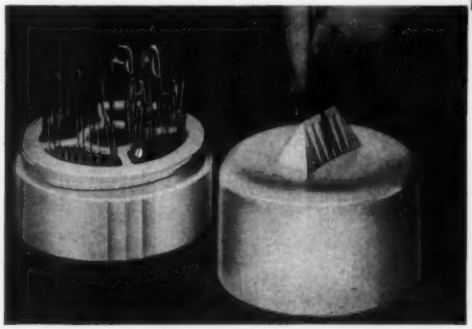
Plastics Plus Magnets

CONTAINERS originally designed simply as holders for a variety of small objects can assume new versatility when the virtues of plastics are combined with the merits of magnets. Four examples of such combinations are shown on this page; permanent Alnico magnets are used in each product. The versatility of plastic molding operations makes it a simple matter to mold-in the magnets or to provide for inserting them during assembly. The magnets may be used to hold objects in a container or to hold the container to an iron or steel surface.

COURTESY TENNESSEE EASTMAN CORP.

Pocket-size Magnetic Fly-Bin has base molded of red Tenite II cellulose acetate butyrate. Alnico magnet in each of five compartments keeps hooks and flies from falling out or blowing away. Top is Tenite I cellulose acetate. Made by Norloc Div., Norton Labs, Inc., Lockport, N. Y.

COURTESY HOWARD INDUSTRIES, INC.



Permanent Alnico magnets in walls of Magnetic Pin-Bin hold contents even when box is inverted. Base is injection molded of cellulose acetate. Cover, compression molded of urea, is removed or closed by a quarter turn; crest on top simplifies spreading ends of bobby pins. Colors are ivory, aqua, pink, or red. Accessory for ladies is made by Howard Industries, Inc., Buffalo, N. Y.

COURTESY CHARLES F. ORVIS CO.

Holder for rotating magnet and base of Magnetic Fly Box for fisherman are of opaque Monsanto styrene. Cover, attached by special snap hinge, is produced of clear Dow styrene. Made by General Electric Co. for Charles F. Orvis Co., Manchester, N. H.

Cigarettes, coins, glasses and similar items can be held in the three compartments of the Magnatray, designed primarily for use in automobiles. The tray, injection molded of metallic gray Lustrex styrene with Alnico magnets in base, will adhere to any steel part of the car, yet may be moved easily. Tray molded by Creative Plastics Corp., New York, for Polyscope Equipment & Appliance Co., Inc., Brooklyn, N. Y.

Styrene's March

COURTESY THE DOW CHEMICAL CO.

Polystyrene housewares of improved design and with wider color ranges result in greater sales and more satisfied buyers

THERE never seems to be enough polystyrene to satisfy everyone—there wasn't enough even before Korea. Yet in the first few months following World War II polystyrene was a comparative stranger on merchandise shelves. Retailers weren't happy about what little they saw of it and molders fussed about degating, poor flow, dirt, streaking, limited color range, brittleness, yellowing, and various other deficiencies. At that time, only a few molders had had much experience with the material since a comparatively few million pounds had been available during the war, and nearly all of that had gone into electronic applications. Like most chemicals, polystyrene needed research developing and experience in handling to prove its full value. Hence, the polystyrene made in 1950 is so different and so much improved over the polystyrene produced in 1945 that it might almost be classified as another material.

One producer reports that in 1948 he had an average of seven complaints per million pounds sold. In the first half of 1950 the figure was reduced to two per million.

Largest Volume Material

Most of the old deficiencies or defects have been overcome or modified to such an extent that polystyrene has become the largest volume material in the plastics molding industry. The few present-day complaints about its performance are confined largely to those who take no heed of its limitations or who use it for impractical applications.

Polystyrene is usually synthetisized from chemicals obtained from two base materials—coal and petroleum. From the former comes benzol; from the latter, ethylene gas. The gaseous ethylene is combined with benzol to form ethyl benzene. The liquid ethyl benzene is then vaporized with high temperature steam and passed through a catalyst bed to achieve a "cracking" or rupture of the ethyl part of the ethyl benzene, resulting in a liquid product called styrene monomer.

When heat is applied to the styrene monomer, the molecules hook themselves to each other to form a giant polymer or polystyrene. If the reaction proceeds too rapidly, the resultant polymer may be too low in molecular weight and too brittle for most purposes. If too slow or at too low a temperature, the polymer may have a high molecular weight and may be difficult to

# of Triumph

Molding material, in four years, has outgrown many of its troubles. Here's where it stands today

mold. The "cooking" of styrene monomer to form styrene plastic is therefore essentially a matter of using the proper combination of temperature and time to achieve the most desirable physical properties and molding characteristics.

Each producer of styrene plastics has a somewhat different technique for polymerization. Vast improvements have been made in the various polymerizing processes since 1945, with each supplier asserting that his process gives superior results, especially for some particular property. However, all producers are reluctant to release information concerning the particular part of their process for which they claim superiority.

Modern Methods

One of the most important improvements has been the outmoding of the old "can" method whereby the liquid was run off into cans and allowed to harden. This batch method of production was responsible for several deficiencies that have been rectified in modern polymerization and processing equipment.

Originally, blocks of polymerized styrene were crushed on mills in batches of 100 or 200 lb., and colorants were added if desired. The material was open to the air and hence subjected to contamination. Variations resulted from batch to batch, depending upon the amount of time it was milled, the temperature, kneading action, etc. The rolling mills were expensive, slow acting, and required considerable personal attention while in operation. After the material was rolled, it was run through a rotary cutter to produce granules, which varied in size and shape. The granulating process also produced large quantities of fluffy fines which settled to the bottom. The resulting molding material had a high bulk factor—that is, there was a considerable amount of air space in the fluffy mass. This high bulk factor of the early styrene plastic molding powder often made it impossible to feed the injection machine with more than 50 or 60% of its rated capacity.

The first step in eliminating the high bulk factor was to screen out the fine; but far more significant was the switch to extruders to do the work formerly done on mills, and the initiation of a continuous process of manufacture from monomer to finished granule. Extruders take a dry blend of crystal polymer and weighed-out colorant and mill them together in the presence of heat and pressure created between the screw flights and walls of the extruder. The heated chamber of an extruder is much more readily controlled than the heated rolls on a mill. Moreover, the entire extrusion process provides a much more satisfactory tool for color dispersion and assures more consistent properties than the old-time batch and mill method. The extruder runs continuously and insures constant processing conditions day after day.

When the polystyrene emerges from the extruder, it is in the form of strands which are then cooled by a water bath or other means and passed along to a chopper running at a speed synchronized with the extrusion rate to insure consistent particle size.

The main factor in this processing phase is that the pellets be con-

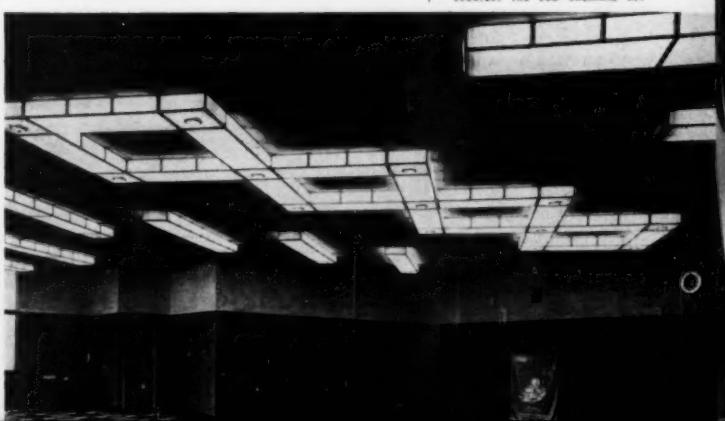
POLYSTYRENE SINCE 1946

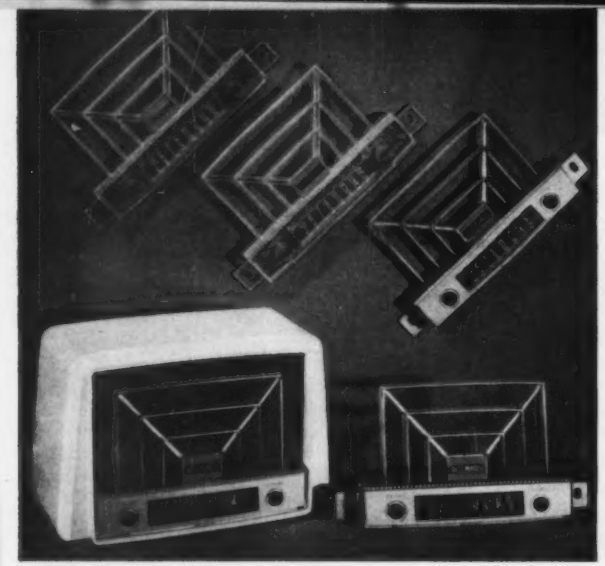
The following list of typical polystyrene applications was compiled by a raw materials producer to symbolize the evolution of the material by tracing the size, variety, and complexity of products made from 1946 to 1950.

1946	Poker chips Water tumblers Key rings and small gadgets Combs
1947	Polyflex sheeting Household items—egg boxes, small plates, tumblers, utensil handles
1948	Monofilaments Refrigerator breaker strips Small crisper drawers Small battery cases Simple toys
1949	Wider use in refrigerators Small television escutcheons Complicated toys Brush backs Packaging Accordions
1950	Large television escutcheons Refrigerator crisper drawers and other large pieces Large battery cases Piping, fittings Clear sheets, rods, and tubes Sound records

Polystyrene is light stable, gives excellent light diffusion; these properties—plus light weight—make it particularly useful in lighting fixtures

COURTESY THE DOW CHEMICAL CO.





COURTESY MONSANTO CHEMICAL CO.

Styrene can be molded into complex parts—such as the combination grille and dial on this radio. Parts at top show steps in finishing

COURTESY THE DOW CHEMICAL CO.

High-impact resistance of polystyrene has resulted in wide use of material in refrigerator parts

sistently cut rather than ground or crushed. This aids in the elimination of fines, permits more uniform heating, provides lower bulk factor.

Further advantages of an extruder over a roll mill in a supplier's polystyrene production line include cost reduction of the finished product. Also, the extruder is entirely enclosed and, when equipped with a screen, helps eliminate contamination, improves clarity, is much faster, produces less scrap, and cuts labor cost. A mill required two men; one man can run several extruders.

Lubricated Material

There are some authorities in the industry who insist that the incorporation of lubricants in styrene molding material has achieved the most improvement, from a working standpoint, of any advance made in the decade. In the early 40's no lubricants were used at all. However, a few experiments with external lubricants made by molders in the late 40's led to a rapidly expanding use. Some molders simply threw in a bit of lubricant, often ten times more than needed, scarcely realizing the importance of what they were doing. It is now customary for suppliers to use lubricants in nearly every formulation.

Lubricants are both external and internal. The external lubricant is on the surface of the granule. It serves to reduce friction between the granules as they move through the rear part of the injection cylinder and while the material is still unfused. The lubricant helps to prevent waste of injection pressure in the back part of the cylinder by reducing the coefficient of friction.

In the middle part of the injection cylinder, where the molding material becomes semi-fused, the external lubricant begins to mix with the granules. As an external lubricant it loses its effect at a point where the hard pellet begins to flow. At this point the external lubricant joins up with a previously incorporated internal lubricant to decrease the viscosity of the plastic compound without the necessity for increasing the temperature. The final result of this lubrication is that the mold cavity generally can be filled with molten styrene at a lower temperature. Thus there is less danger of material breakdown because of high heat; there is less heat to remove from the die; consequently, the molding cycle is shorter.

Better lubrication is claimed to be a major factor in the molder's ability to mold ever larger and more complex pieces of polystyrene. The lubricants most generally used are stearates or other chemical salts and various types of waxes.

Lubrication has also helped to improve the color range for styrene since lowering of the average molding temperature made possible by lubrication brings into the picture colorants whose decomposition points are below the molding temperature required without lubrication. Better mold release is another benefit of lubrication.

Color Range Extended

One of the complaints flung at styrene plastic back in 1946 was that it couldn't compete in range of color with other thermoplastics. The challenge was accepted, and today one company alone can furnish any one of 5000 different shades and has facilities to match countless additional shades upon request.

Unique sidelines of the development of styrene plastic colors have been the creation of special effects such as metallic, phosphorescent, fluorescent, pearlescent, and marble or mottled material. Each effect may require a special treatment or material. Thus it was found that luminescents using a strontium base were not as stable as calcium base luminescents and limited the range.

The metallic colors widened the potentialties of polystyrene to an almost unbelievable extent. Beginning with copper-colored flower pots, the parade has been unending.

One ingenious application was a molded metallic colored styrene grille for an electric fan. It was solid and substantial and gave the appearance of metal but saved the expense of stamping, grooving, and assembling. A more simple piece is a simulated copper serving tray that the consumer can buy at an unbelievably low cost in comparison to genuine copper. Styrene plastic thermostat housings that look like metal but bypass the necessity for metal blanking, stamping, and spraying are on the market. A shower rod bracket formerly in cast aluminum is now molded in aluminum-colored styrene. Three or four years ago no one ever dreamed that metallic colored polystyrene would actually step into places that were thought to be the birthright of metal.

Mottled Effects

The use of two colors to give a mottled effect for wall tile and other uses has been another interesting development, but the technique is largely mechanical. The effect desired is obtained by regulating the percentage composition of the different colored pellets fed to the injection cylinder, and by controlling gate size in order that proper flow be channeled into the cavity to obtain the desired mottle. A tiny gate makes a dull mottle—a large gate makes one of the two colors dominate. To aid such color combinations, raw material companies have developed color concentrates that are compatible and won't bleed into each other easily.

A new styrene color improvement is a dichromatic pigmentation. It is used primarily for transparent colors and is likened to the effect of a stereopticon—the viewer sees a depth of color that gives a type of glistening effect somewhat akin to irridescence.

After all, color is one of the top sales appeals for plastic articles and it is no wonder that so much time and money have been spent on color problems. It is interesting to note that several suppliers are now encouraging molders to do more of their own coloring even though admitting that the final coloring job may not be quite as good as it could be. The idea is that the molder can buy crystal and do his own coloring at less cost than he can buy colored pellets, provided he buys specially formed and treated granules and follows certain compounding directions. However, he is limited to certain applications where color dispersion and consistency are not too critical.

Heat Resistance

Another advance in styrene molding material has been in the development of higher heat resistant material. A styrene tea strainer was ridiculed in 1946 for the harm it would do the industry, but styrene tea strainers are commonplace today. The material now employed is not designed to withstand constant boiling but it will withstand as many scaldings as the average metal strainer.

Other kitchen equipment has benefited from the use of this high heat resistant material. When first developed, it was too stiff to flow easily around corners or from thin to thick parts of the mold, but the addition of lubricants and development of other techniques have eliminated that trouble. The higher heat resistant polystyrene requires higher molding temperature. But it sets up more quickly in the mold; hence the cooling portion of the cycle is shortened, and the end result is a shorter cycle. Some of these materials are styrene plastic with a properly adjusted molecular weight, while others are modified styrene plastic.

Loss of color or yellowing after aging was another early fault in styrene plastics. The trouble was often caused by overheated and unpolymerized monomer. As much as 6 or 7% of unpolymerized material was sometimes present in the granule. Today that proportion has been reduced to less than 2 percent. The effect of oxygen and ultra-violet also caused polystyrene to yellow, but the improved polymerization procedures and handling techniques have minimized the oxygen and ultra-violet effect and thus improved aging properties.

Higher impact polystyrene, obtained without changing major physical properties of the material, is a comparative newcomer in the field. It has already had a marked effect on improved refrigerator parts in particular.

Aging is a problem with high impact styrene. High impact material may be little different from standard styrene after six months unless it is manufactured with a certain technique. Considering that the material might be used in coldest Alaska or in a high altitude plane or inside a hot dairy barn in Alabama, it's easy to understand the difficulties involved. Nevertheless, high impact material of suitable quality is at hand and widely used—molders wish there were much more of it.

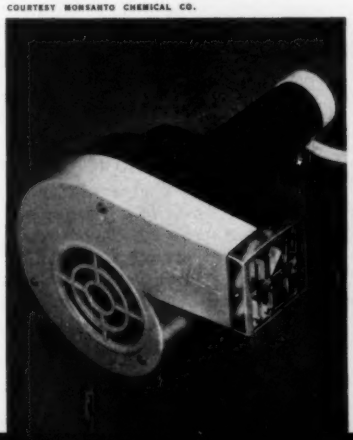
Large Moldings

Probably the two most publicized items that have taken greatest advantage of the advances in polystyrene quality are refrigerator hydrators or crispers and television screens. The hydrator tray must be molded from a material which is capable of being heated so that it will flow to the far corners of the cavity without setting up. During its progress the material loses heat to the metal through which it passes, and surface marring may result if

(*Continued on p. 174*)

Development of a heat-resistant styrene made this hair drier housing practical

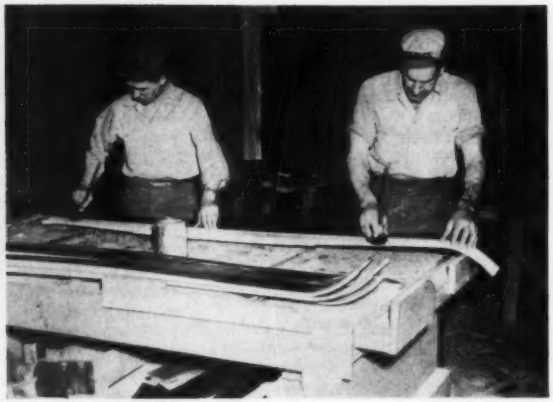
COURTESY MONSANTO CHEMICAL CO.



Styrene for television windows must be clear and free of contamination

COURTESY THE DOW CHEMICAL CO.

SKIING ON PLASTICS



PHOTOS COURTESY WESTINGHOUSE ELECTRIC CORP.

Standard grade Micarta phenolic laminate is cut to size for ski bottoms in the factory of Bancroft Racket Co.

After the phenolic laminate ski bottoms have been cut to shape, operators apply adhesive to laminate and to the hickory ski

SEVERAL leading sporting goods manufacturers have recently adopted plastics as a material for ski bottoms and other ski parts. In the bottoms particularly, the plastic materials used have proved themselves superior to wood because of their wear resistance, their self-lubricating qualities, their resistance to moisture, and their uniform smoothness.

Cellulose nitrate sheet and high pressure phenolic laminates are among the plastic materials being used.

Nitron cellulose nitrate sheet 0.060 in. thick is being used for ski bottoms by Northland Ski Mfg. Co., Laconia, N. H., and A. G. Spalding & Bros., Inc., Chicopee, Mass.

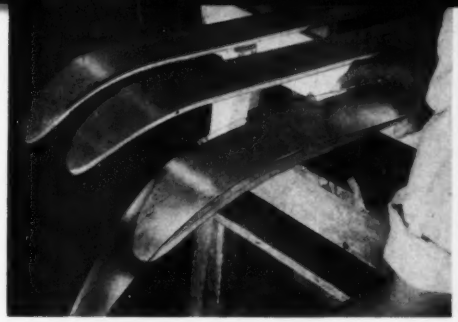
Before the nitrate soles are applied, the wooden ski bottoms are rough sanded, and about a dozen rough saw cuts are made lengthwise, 1/16 in. deep and 1/16 in. wide. The surface is then primed with Monsanto NC200 cement cut with three parts acetone to one cement.

After the prime coat has dried for 24 hr., a heavy coat of cement is applied, and the ski and the nitrate sheet are bonded at 250° F. and 300 p.s.i. pressure for 5 to 15 minutes. The assembly is cooled under pressure. Metal edge strips are then screwed on over the nitrate sheet.

Northland as well as Derby and Ball, Waterbury, Vt., are also using Nitron sheet for decorative edging on the topsides of skis. Rabbets are routed out the desired width and depth, and the surface is primed in the same manner as the ski bottoms. A 14-in. wide nitrate strip is then softened in acetone for 20 to 30 min., and the softened strip is pressed into the groove and then dried at room temperature.

Bancroft Racket Co., Pawtucket, R. I., is using Micarta phenolic laminate for the bottoms of many of its hickory skis, and Head Ski Co., Baltimore, Md., is using Formica phenolic laminate in its new Expert ski. As shown in the cross-section diagram at the bottom of the opposite page, the Expert ski has bottom and sidewalls made of Formica and, in some models, a Formica top sheathing. A thermosetting resin adhesive is used to bond the laminate to the ski.

Because water is the best lubricant for the material, skis with phenolic laminate soles are faster than the finest hickory skis. They need no waxing, except in very wet snow, and will outlast hickory without refinishing.

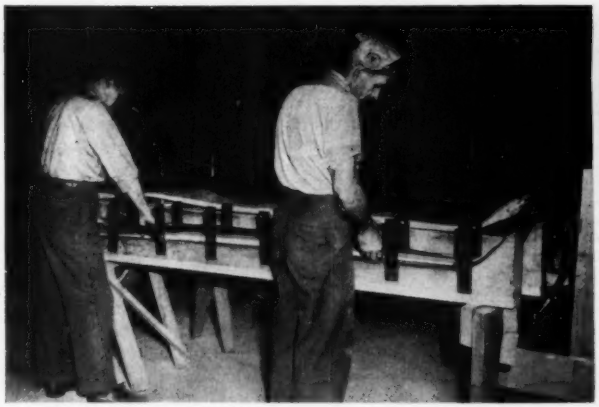


Operator applies nitrate strip to bottom of hickory ski. Note metal edges on finished ski (top)

PHOTOS COURTESY MONSANTO CHEMICAL CO.

Decorative cellulose nitrate strip ¼ in. wide is applied to groove in top of Northland ski

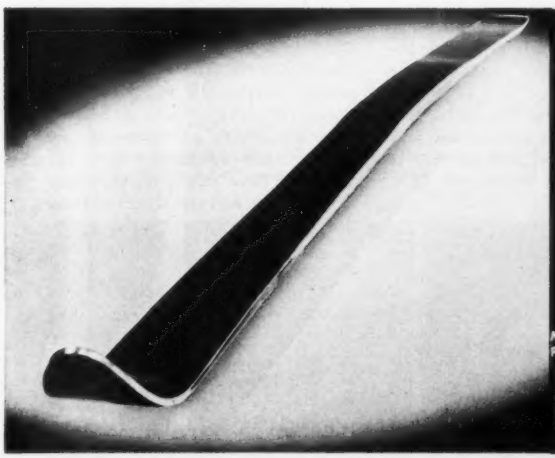
Finished Spalding ski. It is hickory, has nitrate sole



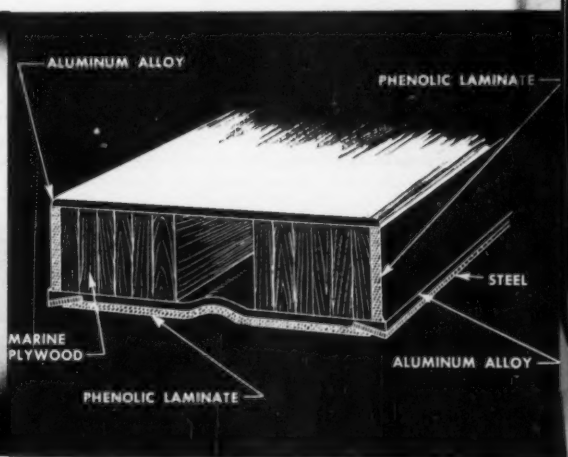
PHOTOS COURTESY WESTINGHOUSE ELECTRIC CORP.

The laminate bottoms and the wooden skis are laid up in wooden jig and permanently bonded to each other in Bancroft Racket Co. plant

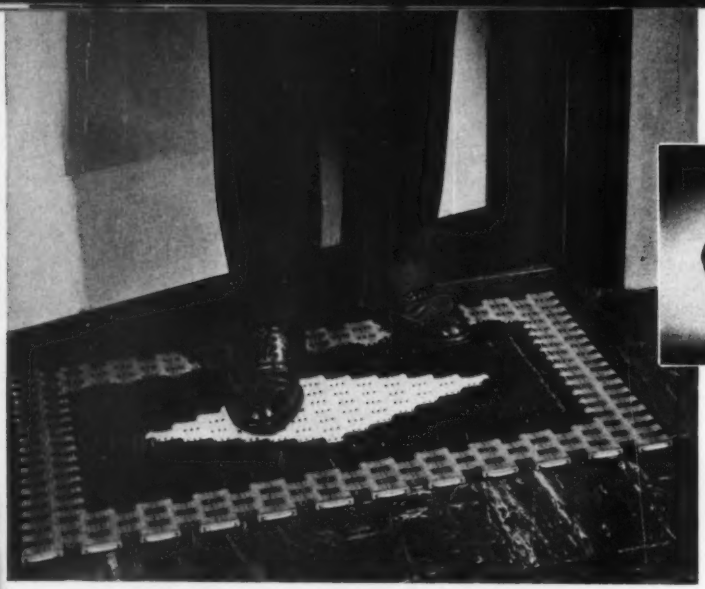
Bancroft ski with Micarta bottom is fast without wax, durable without refinishing

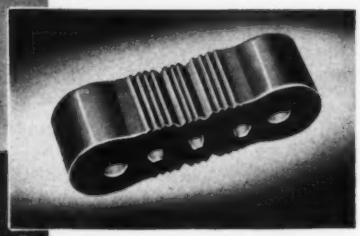


Head Expert ski has Formica phenolic laminate bottom and sidewalls. Laminate is also used for tops of some models



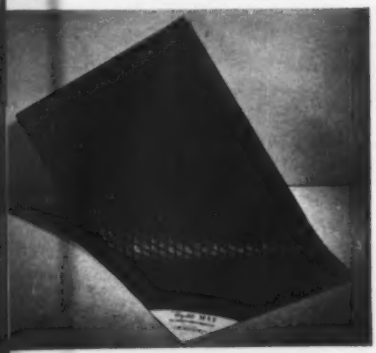
Cross-section diagram of Head ski. Laminate sidewalls are 0.090 in. thick. Bottom (and top, when used) is 0.025 inch





Unlimited colors and superior resistance to deterioration make vinyl more practical than rubber for floor mats. Left: Link mat made by Melflex Products Co., Inc., is produced in four sizes. Above: Close-up of a single link

Vinyl Makes Better Floor Mats



One-piece vinyl mat is molded by Plymouth Rubber Co., Inc.

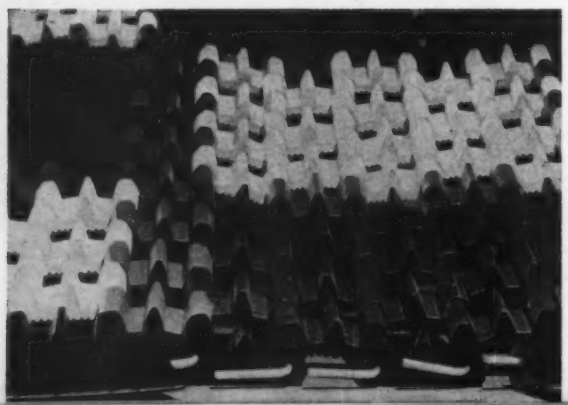
LINK mats and other types of floor mats which have always been made of rubber are now being made of vinyl. Although vinyl offers many advantages in such applications, the most important is that vinyl has much greater resistance than rubber to gasoline, oils, grease, fats, and acids. The vinyl mats will thus last almost indefinitely on oily floors, in kitchens, and in other locations where rubber will not stand up.

The vinyl mats are also more attractive than rubber mats because of the unlimited range of bright colors possible with the plastic material. Because the non-porous surface of vinyl does not absorb dirt and can be washed easily, the vinyl mats retain their new look.

Melflex Products Co., Inc., Akron, Ohio, is producing vinyl link mats in four standard sizes and is using the same vinyl links to assemble mats of any size on special order. The standard sizes, available in black with red border and center, are: 17 by 25, 18 by 30, 24 by 36, and 30 by 48 inches.

American Mat Corp., Toledo, Ohio, is producing link mats called Evertred mats. The links are currently being made in five colors: green, red, brown, white, and black. They are slightly corrugated on one side to make the surface non-slipping and have ridges on the other side for easy dirt removal. The mats are available in any width up to 5 ft., and may be obtained in any desired length.

Vinyl is also being used to produce one-piece molded mats. Plymouth Rubber Co., Inc., Canton, Mass., which is producing such mats of Vinylite material, is convinced that "they will outwear any rubber mat at least three to one."



Links in American Mat Corp.'s mat have corrugations to prevent slipping and ridges for easy dirt removal

ETHOXYLINES: what they are where they are going

BY E. PREISWERK* AND J. CHARLTON**

With manufacture of the new ethoxyline resins now starting in the United States, new applications are bound to come forth rapidly. Because of the characteristics of these new resins, the metals and electrical fields will be the first to feel their full impact. But other industries will find much of interest in ethoxylines. They will bear watching.

SOME five years ago, a new group of resins appeared on the European market. These resins, available in forms suitable for bonding, casting, and surface coatings, immediately attracted the attention of specialists in certain fields because of some of their extraordinary properties. Belonging to a single characteristic resin class, the new resins have been given the name of ethoxylines[1].

The basic ethoxyline resins are thermoplastic in character, but when cured or hardened the final product is thermosetting. The hardening agent used is not a normal type of catalyst, but becomes an actual part of the resin. Curing of ethoxylines can proceed at room temperature or at elevated temperatures and the hardened products exhibit the following interesting properties: 1) Minimal shrinkage during hardening; 2) Exceptionally high adhesion to the surface of materials with which the resins come into contact during the hardening process; 3) Practically no elimination of fugitive materials (condensation by-products, monomeric units, etc.) during the curing process; and 4) High mechanical strength, notable chemical resistance of the cured resin, and outstandingly good dielectric properties.

Basic Forms

The three basic forms of commercial ethoxylines—bonding, casting, and surface coating—are available in seven different groups. These include a heat-setting adhesive in solid form, a heat-setting and two cold-setting adhesives in liquid form, a casting resin, and two surface coating resins.

The bonding resins make possible the joining of metals, ceramics, glass, plastics, etc., together and to each other without the use of pressure. In metal-to-metal bonds, these resins provide a joint which can be the equivalent of riveting, welding, or soldering; in many cases the bond is even better. As to cost, Araldite ethoxyline bonding resin is competitive with solder on a coverage basis.

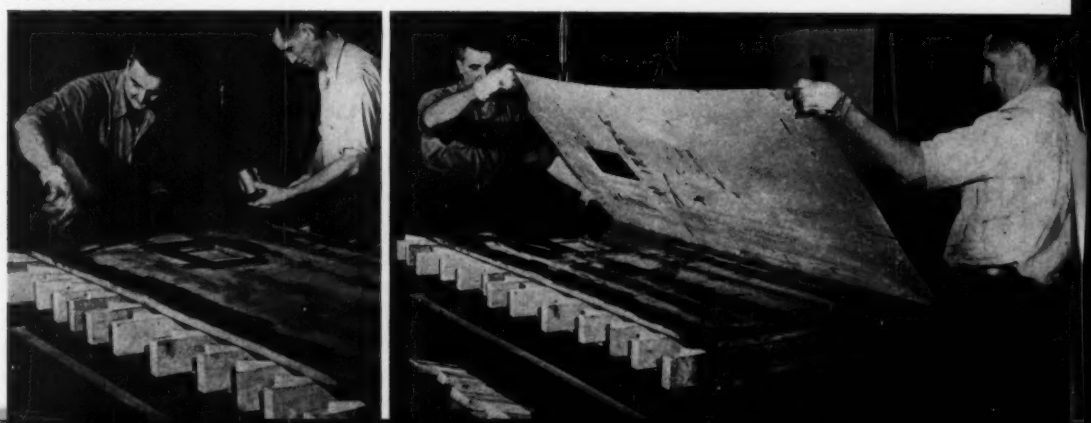
The heat hardening bonding agents exhibit bond strengths which persist up to a temperature of 248° F. At very low temperatures (to −76° F.) no brittleness develops and no cracking occurs. The resins can be applied in the form of sticks, tablets, powders, sheets, or liquids.

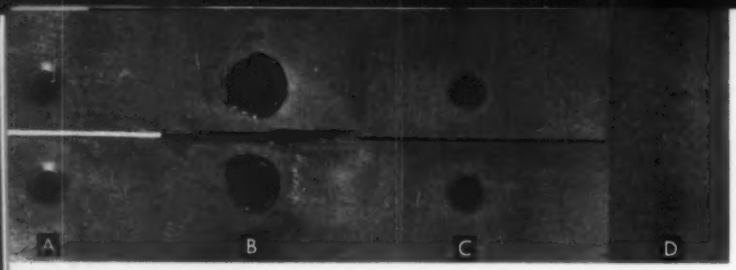
There is no field of metal working where the resin bonding of metals is so welcomed as in the light metal industry. In welding, the hardened light metals are re-softened; in soldering, the junction of heavy and light metals forms a galvanic cell which promotes rapid corrosion on exposure to electrolytes; and in riv-

*Plastics Dept., Ciba Ltd., Basle, Switzerland.
**Ciba Co., Inc., New York.
[1]First resins of this type were supplied to various industrial users under the Ciba trade name Araldite, which covers adhesive, casting, and surface-coating resins. The process of manufacture and use of Araldite resins is patented or patents are applied for in most industrial countries. Ciba Co., Inc., New York City, has erected a pilot plant in the United States to produce initial quantities of the resins.

Using ethoxyline resin to bond a decorative metal panel to the steel door of an elevator. The panel is also mechanically fastened with screws, the resin being used in this application primarily to prevent rattles under vibration

COURTESY OTIS ELEVATOR CO.





Cold-setting ethoxyline resin used for filling screw holes. A) Countersunk holes. B) Holes filled with resin. C) Excess resin removed. D) Surface sanded

Curing Time and Strengths of Type XI Adhesive Joints

Temperature	*Time*	*Shear strength*
°F.		*p.s.i.*
392	20 min.	2987 — 3271
	40 min.	2987 — 3271
	60 min.	3129 — 3414
356	40 min.	2702 — 3129
	1 hr.	2845 — 3271
	2 hr.	2845 — 3271
320	1 hr.	2276 — 2560
	2 hr.	2560 — 2845
	5 hr.	2560 — 2845
284	5 hr.	2276 — 2560
	10 hr.	2276 — 2702
	14 hr.	2276 — 2560
248	10 hr.	1991 — 2134
	14 hr.	1991 — 2134
	24 hr.	2134 — 2418
212	14 hr.	1422 — 1707
	24 hr.	1707 — 1849
	48 hr.	1707 — 1849

eting, much labor is required and the product is often weakened by the rivet holes.

Well established in this field are many bonding materials, practically all of which, however, demand a special bonding pressure in application. The ethoxyline resins form bonds without the need of pressure and thus facilitate the use of resin bonding in innumerable cases where pressure cannot be used either because of the form or the physical strength of the materials to be joined.

The curing conditions for ethoxyline resins lie in a range where the hardening of the resin and the hardening of light metals are both possible. Because they can be used to "weld" light metals to steel, new combinations making use of the diverse advantageous properties of both materials become possible.

In a basic investigation[2] the mechanical properties of Araldite ethoxyline bonded light metal parts were determined and the results made available for general use.

General Uses

An outstanding feature of the casting resins which is of special interest to the electrical industry, is that they permit different electrically conducting metal parts of an electrical assembly to be united with each other as well as with other materials in a unit having good mechanical and electrical properties. Such work can be carried out by a very simple casting procedure and subsequent mild heat treatment.

The application of the new casting resin to condensers, armatures, frequency filters, etc., finds increasingly successful use in practice. Articles of exceptionally high quality are produced which are resistant to tropical conditions. The cast pieces are bubble-free and exhibit minimal internal tensions.

The tracking and arc resistances of ethoxyline castings are remarkably good. The dielectric losses at radar frequencies are in a useful range. Mass production can be accomplished without difficulty. Large pieces (over 200 lb. resin content) have been cast in Europe. The casting and hardening procedure can be adapted to existing manufacturing conditions. No difficulties with storage life are to be anticipated. The casting resins can be combined with fillers up to 300% of the resin content and can thus be made quite inexpensive. The cured resin can be readily machined, turned, filed, drilled, etc., and does not exhibit crazing or other deterioration with age, nor exert corrosive action on metal parts.

The commercial ethoxyline surface coating resins are suitable for producing both clear and pigmented finishes. After baking, the coatings have exceptional adhesion to light alloys, tinplate, steel, and cast iron. They are flexible and resistant to abrasion, can be deep drawn, are glossy, and do not craze. They have outstanding resistance to acids, alkalis, oils, solvents, and water, and are free from taste and smell. Araldite ethoxyline finishes are therefore suitable for the surface protection of metals and particularly for food cans, aluminum foil, collapsible metal tubes, and light alloy drums.

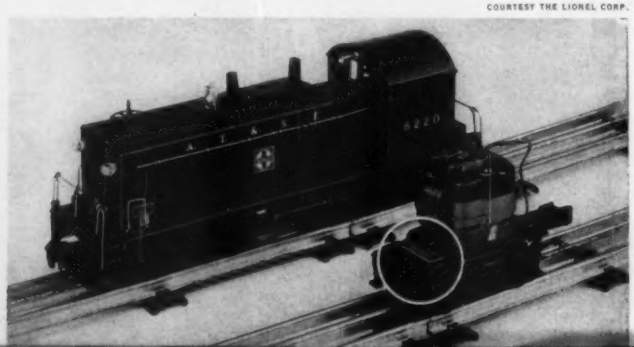
The surface coating resins are supplied as practically neutral solutions of medium viscosity and of

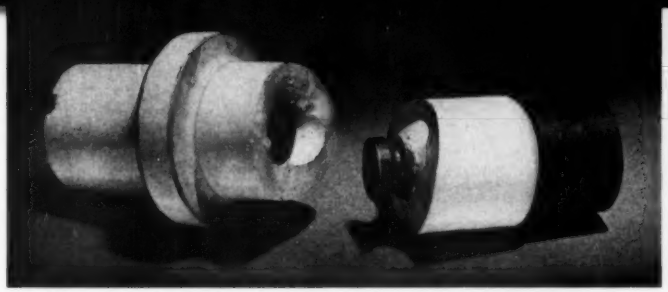
[2] Ros, *Sheet Metal Industries*, London, (Sept. 1949).

A variety of products have been packed in collapsible tubes lined with Araldite

Ethoxyline resin bonding replaces plating and soldering operations in fastening pole pieces to magnets (circle) in motor of model locomotive

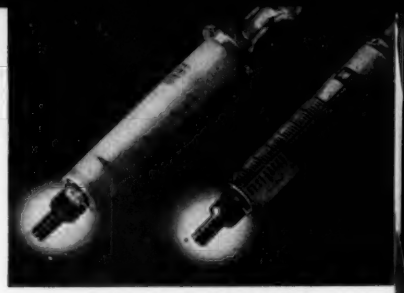
COURTESY THE LIONEL CORP.





PHOTOS IN THIS ARTICLE NOT OTHERWISE CREDITED ARE BY COURTESY OF CIBA CO., INC.

Porcelain was bonded to metal with an ethoxyline resin and the part tested to destruction. The porcelain failed but the resin bond remained intact



COURTESY MACGREGOR INSTRUMENT CO.

Stainless steel is successfully bonded to glass in hypodermics

about 50% solids content. For spraying, dipping, brushing or roller application, the resins must be diluted with mixtures of solvents.

By suitable choice of baking conditions, colorless to brownish-yellow films may be obtained. The insensitivity of the film to over-heating enables repeated coats to be cured without risk of making the undercoatings brittle.

Curing for a longer period increases the chemical resistance of the coating, and the color of the film is a good indication of it. Colorless and light yellow films are more suitable for decorative purposes, and yellow to golden films are required when good chemical resistance is necessary.

Specific Applications

Because of the relative newness of the Araldite resins, many uses of them are still in the design stage or are under test. However, sufficient progress has been made in a number of directions to indicate by example the versatility of application possibilities. The accompanying photographs show a diversity of uses and the following paragraphs review some of the work that has been done.

Bonding: Several seemingly "impossible" cementing jobs are being done in the machinery and machine tool field through the use of ethoxyline bonding resins. For example, wear-resisting metal parts are being bonded to supporting bases, as in the case of tungsten carbide tips for cutting, turning, and boring tools. In textile machines, Araldite has been used to bond sapphire thread guides to aluminum arms, and it is now being tried as a bonding agent for Carboloy runners on oscillating parts of the machines.

By substituting ethoxyline resin bonding for press and shrink fits, one manufacturer eliminated the problem of having to machine to close tolerances and, because the resulting assembly was not prestressed as when a shrink fit is made, the performance is better.

Satisfactory bonds have been made in metal-glass and metal-ceramic assemblies. In one striking case, the metal tip of a hypodermic syringe is bonded to the glass barrel. The resulting joint is so strong that, under test, the Pyrex glass fails before the joint. Further, the adhesive withstands sterilization temperatures and antiseptic solutions. The same resin has also been used to form seals in x-ray tubes,

Shrinkage of Type B Casting Resin

Hardening time	*Hardening temperature*	*Shrinkage*
	°F.	%
48 hr.	230	0.5—0.8
10 hr.	266	1.1—1.3
5 hr.	284	1.3—1.5
3 hr.	302	1.5—1.9
90 min.	320	1.9—2.2
60 min.	338	2.0—2.2
30 min.	392	2.2—2.3

and is at present being used as a repair cement for high vacuum pumps, as a china cement, and in mounting Piezo-electric crystals.

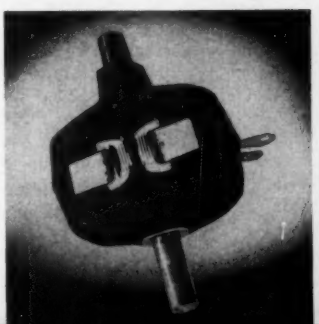
The heat-setting liquid-type resin is now being used as an adhesive for electric motor, dynamo, and transformer laminations because it has high insulation resistance as well as good thermal stability and high adhesive strength. In such uses, the laminations are held more rigidly than when riveted, resulting in the elimination of vibration.

Because of the ability of the cold-setting resins to set with little shrinkage and without separation of volatile solvents, they are showing increasing acceptance for such uses as bonding metals to glass, as china repair cements, etc. In one case, decorative metal coverings are bonded to elevator doors, and the wainscotting of the cabs is fastened to the frame with Araldite.

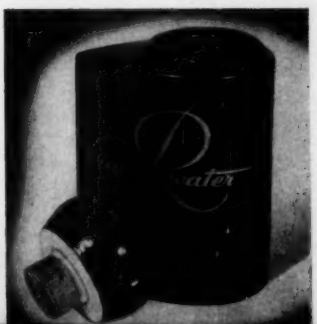
At an opposite extreme, cork stoppers are being bonded to the ceramic tops of toilet water bottles. The cold-setting type resin produced the required strength and chemical resistance for this use.

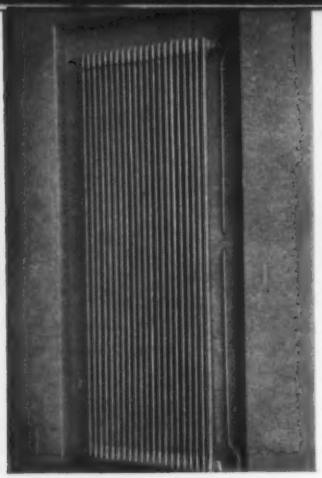
When the cold-setting adhesive is combined with an inert filler, the result is a tile cement of high alkali resistance, or a shrinkless body "solder" for auto and bus body

Section of small transformer potted in ethoxyline casting resin



Ethoxyline resin strongly bonds cork stopper to its ceramic top





Household radiator made of light metals in which joints are bonded with Araldite ethoxyline resin

Cast ethoxyline resin machines easily, has been used in producing valves up to 9 in. in diameter

work. The latter application is particularly interesting for bus body work since the "solder" exhibits good adhesion to aluminum. Similar compounds are being used to fill cracks and screw-head holes in wood. When the filler is wood flour, the compound dries hard in a short time, even in thick sections, and shows no shrinkage. It can be sanded and stained to match the parent wood.

Ethoxyline bonding resin is being tested in the assembly of fin-tube radiators, where it permits the manufacturer to bond copper tubing to aluminum fins, and, if desired, color the fins simultaneously. The same bonding advantage is also attractive in refrigeration applications. Here it is possible to make joints with a technique similar to soldering without the necessity for fluxing and flux removal. Return bends and refrigerant lines of aluminum may now be constructed and joined in much the same manner as copper is soldered. Wherever it is necessary to join copper lines to aluminum lines, the adhesive provides a satisfactory method.

In the abrasive and ceramics industries, ethoxyline resin has been successfully used in the construction of diamond wheels, the bonding of abrasive burrs to steel shanks, and in making metal-ceramic bonds. Investigations are under way, at present, aimed at putting Araldite-graphite mixtures into production in the manufacture of printed electrical circuits on ceramic bases. Araldite resins have also shown promise in ink formulations for printing on glass bottles. Resistance to boiling water and abrasion are important in such applications.

Because the heat-setting solid type of resin is heat stable and has a low vapor pressure (less than 10^{-6} microns), experimental television picture tubes have been successfully made and, when production problems are solved, significant advantages are promised. When an adhesive is used, the fluorescent coatings can be applied before the cone and face plate are joined, and the joint made without damage to the coating.

Casting: The ethoxyline casting resin is being used in this country in many electrical applications. As a potting agent for high-tension cable tips for x-ray machines, its merit lies in its high insulation value and temperature stability. In television receivers, it is being used for potting of high voltage components because of its high dielectric strength, corona resistance, and its ease of working.

Special shapes can now be obtained from custom makers of ethoxyline castings, and castings are now available in rods up to 5 in. in diameter, in sheets 18 by 18 in. (up to 1 in. thick), and in tubes up to 2 in. o.d.[3] These shapes are being used in electroplating work because of their resistance to the solutions encountered. Since the cast resin machines easily, it is also used in the manufacture of automatic screw machine products. Valves up to 9 in. in diameter have also been cast in this material.

Because of its high thermal stability, electrical properties, and good wetting properties, ethoxyline casting resin shows promise as a low pressure laminating resin for glass reinforced laminates.

Surface Coating: Because of their adherence to metals, surface-coating ethoxyline resins are being used as corrosion resistant can liners, as insulating varnishes, and as impregnating varnishes. They have been successfully used to line chemical tanks, an application which is indicated for equipment handling chlorine, hydrochloric acid, phosphoric acid, and calcium hypochlorite solutions. Prototype apparatus using Araldite coating and casting resins for these purposes is now performing quite well.

In impregnating porous castings for Diesel engines, the use of ethoxyline surface-coating resin has proved successful because of its adherence strength and heat stability. Some Diesel busses have been in operation for many months with Araldite as the sealant in the cast heads of the engines.

In the foregoing paragraphs, no attempt has been made to give specific details regarding any one or any group of applications for ethoxyline resins. Many experimental uses of them have not even been mentioned. But enough has been recorded to indicate the versatility of these new materials and to point out the ways in which they are developing. It is significant to note that many of the present applications amplify the usefulness of other materials. Thus the ethoxylines, by making possible new combinations involving metals, ceramics, and plastics, for example, should contribute largely to the future technology of many materials.

[3] Houghton Laboratories, Inc., Olean, N. Y.

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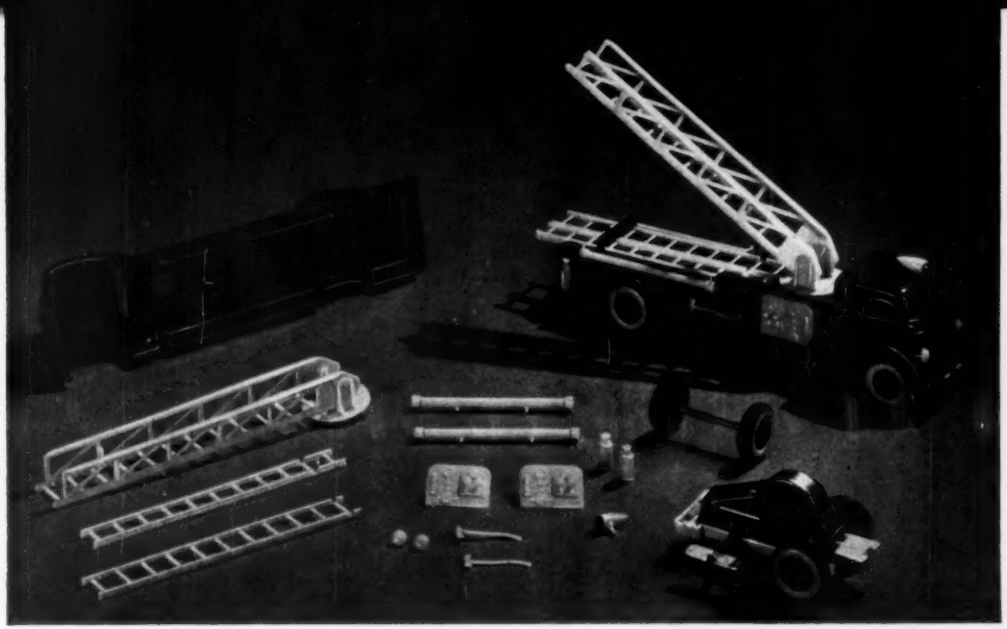


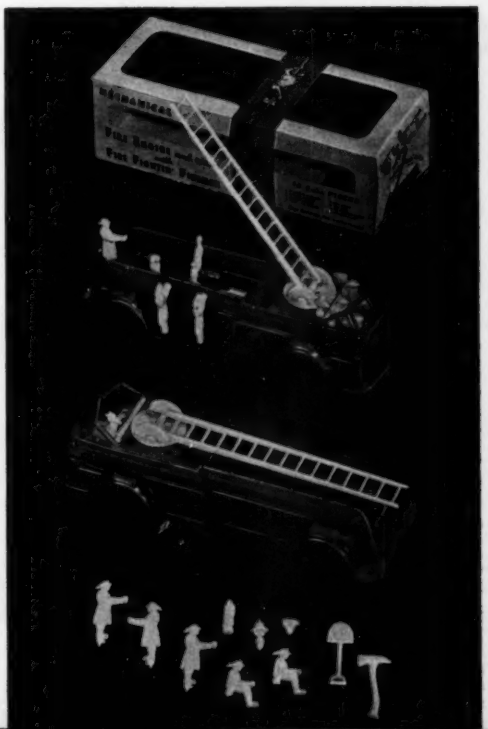
Faithful reproduction of fire engine accessories lends realism to this toy molded of cellulose acetate. Parts, produced in white, snap-fit to the red body. Among removable parts is a motor-siren unit; siren sounds when motor is running

More Play Value in Toys

THE use of separately molded, easily removable firemen and other accessories has greatly increased the play value of two inexpensive plastic toy fire engines now on the market. The child who owns one can thus have the fun of taking the accessories off and "using" them to fight make-believe fires.

The Firefighter, shown at the top of this page, is molded of cellulose acetate by BW Molded Plastics, Pasadena, Calif. The body is molded of red material, and all other parts, molded in white, snap-fit to the body. The removable parts are the motor chassis to which the wind-up motor and siren are attached, the ladder, two extension ladders, two hose lengths, two fire extinguishers, two axes, two control panels, the headlights, and the cab-top searchlight.

The Mechanical Fire Engine, shown at right, is molded of styrene by Nosco Plastics, Erie, Pa. It also has a wind-up motor and siren. The body of this toy is molded in red, and the seat, molded in white, is permanently attached. The removable parts, molded in white and yellow, fit into keyhole-shaped holes on the running board and seat of the toy. The removable parts are the ladder, three standing firemen, two sitting firemen, a bell, a searchlight, an axe, and a shovel.



White and yellow parts of styrene fire engine fit into keyhole-shaped holes on running board and seat

From Zinc to Acetate

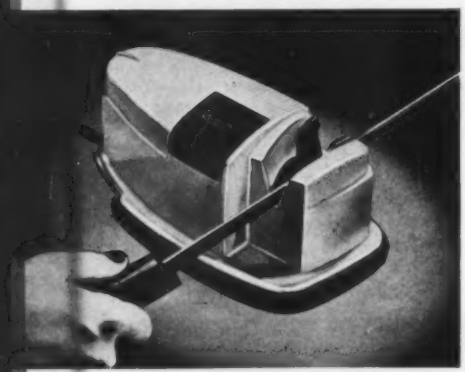
A LEADING advocate of properly applied plastics in the small appliance field, Cory Corp., Chicago, Ill., is utilizing a variety of plastic materials in its well-known line of coffee brewers, air circulators, and small household fans. One of the company's latest moves in this direction was the replacement of the zinc die-cast housing on the Cory electric knife sharpener with a molded cellulose acetate housing.

In the original sharpener, introduced about two years ago, the only plastic part visible on the outside of the unit was a black phenolic switch with the company name wiped-in in white enamel. The zinc housing, finished in white enamel, was designed by Palma-Knapp Associates, Chicago.

Although the metal housing was modernly styled, the manufacturer decided, upon further investigation, to change over to a molded plastic housing. Experimental moldings, using the same dies from which the die-cast parts were produced, confirmed the wisdom of this decision.

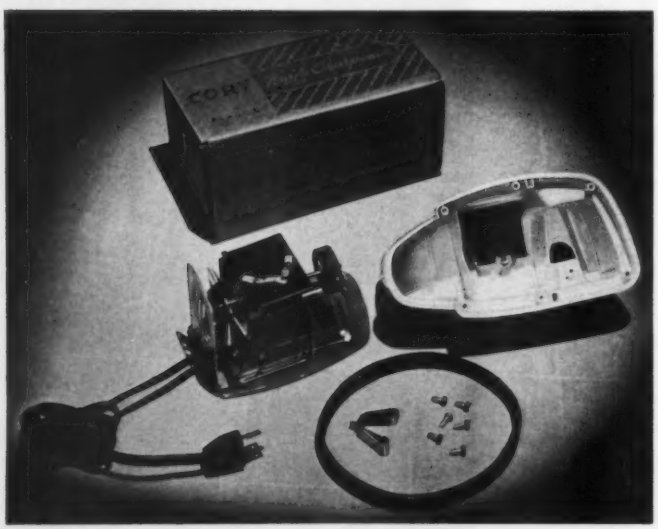
The new plastic housing, used for the Model DKS-2 sharpener, closely simulates the appearance of the original unit. However, it has a wider, more stable base to eliminate possible tipping of the sharpener when in use. Whereas the metal housing was designed with slots which went all the way through the case, the plastic unit fully covers the sharpener, except at one end of the base, and has a series of shallow ribs for appearance only.

Principal advantages gained in adopting the plastic housing include reduction of manufacturing costs, improved appearance and quality, elimination of surface-finishing operations, and reduction of weight, resulting in lower shipping costs. With the closed-housing design, there is less likelihood of dust or dirt finding its way into the small electric motor which powers the appliance. A miniature fan on the motor shaft supplies ample cooling.



Molded cellulose acetate housing for knife sharpener forms almost complete enclosure which reduces entry of dirt or dust into electric motor. Series of shallow ribs on cover enhances the appearance

Acetate housing, right, to which metal plate supporting motor is fastened, has cored bosses which engage thread-cutting screws. Additional bosses anchor knife support clip and phenolic operating switch



100 Housings Per Hour

Restyling of the sharpener was also handled by Palma-Knapp Associates. The new housing, measuring just over 8 in. long by 4¼ in. wide by 3½ in. high, is produced of white Celanese hard-flow heat-resistant cellulose acetate. Molding is done by Superior Plastics Div., Commonwealth Plastics, Inc., Chicago. The casing is run in a two-cavity die on a 24-oz. Reed-Prentice machine averaging 50 shots per hour.

In the redesigned sharpener, the housing itself is relatively divorced from the weight of the working parts. The motor and shaft assembly are fastened to a metal base plate which, in turn, is joined to the housing by means of six thread-cutting screws engaging cored bosses in the skirt-like flange at the bottom of the base. Two additional cored bosses provide similar anchorage for the phenolic switch and knife guide clip.

Other features of the acetate molding include a deep internal rib which provides additional strength and prevents the mechanism from shifting within the case, and a transverse slot which supports a perforated metal guard in front of the air intake fan.

PHOTOS COURTESY MOULDED PRODUCTS LTD

Right: Finished light-wight fire helmet, molded of phenolic-impregnated linen, has clipped-in harness. Above: Helmet being removed from molding press. New molding technique was evolved to protect linen fibers

Above: Additional plastic is applied to points of greatest stress to prevent breakdown of fibers. This is done just before draw molding on 400-600 ton press at 360° F. Production averages from 3 to 4 helmets an hour

Phenolic-Impregnated Fire Helmet

USE of a pre-forming and deep-draw molding technique has made possible the production of a new phenolic-impregnated linen fire helmet which is now in use by leading fire brigades in the United Kingdom. The new helmet has been awarded official approval by the Fire Service Dept. of the British Home Office following successful tests by the Dept. of Scientific and Industrial Research and the National Physical Laboratories.

This new plastic helmet, the outcome of research by Moulded Products Ltd., Birmingham, Eng., does not deform or discolor under heat conditions encountered in fire fighting. Self-colored black, it needs no surface application of color which might chip or abrade in use; it provides better ventilation through a clipped-in harness; it is light in weight; and it can be sold at half the price of other helmets.

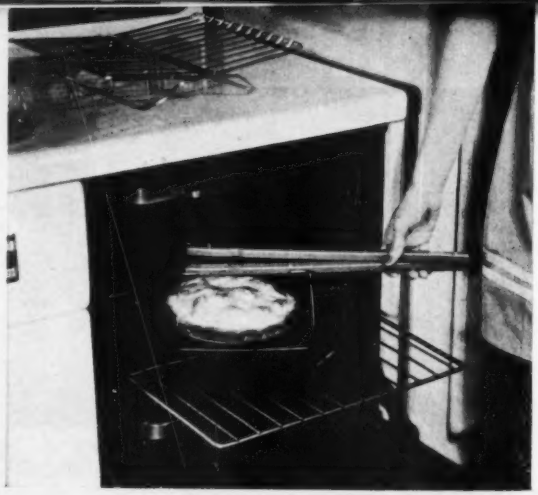
Weight and ventilation of helmets assumed a new importance during World War II air raids on Britain. Of even greater consequence to the lives of firemen is the danger of electric shock, a danger which is magnified by the use of metal helmets. Hence, British authorities turned to plastics for an answer.

The problem was brought to T. A. Cave, technical representative of Moulded Products Ltd. Designs were obtained from the Dept. of Scientific and Industrial Research and the Fire Service Dept. of the Home Office, and experimental work was started. Because of its many known advantages, phenolic impregnated linen was selected for the material, but a new molding technique had to be evolved which would not damage the linen fibers by stretching. This was accomplished by (a) folding the material to the required dimensions without cutting; (b) preforming in a low-temperature press; and (c) draw-molding to final form in a 400-600 ton press at 360° F. Just prior to the drawing operation, additional plastic material is added at points of greatest stress to prevent breakdown of the fibers during the molding operation. Production time averages three to four helmets per hour, depending on shape.

In the laboratories named above, the helmet survived these tests:

1) A 14-lb. weight dropped on the crest four times from a height of 12 feet. 2) A 14-lb. weight dropped on the shell four times from a height of 12 feet. 3) A 2-lb. bullet-shaped weight dropped on the shell from a height of 12 feet. 4) A 12-in. square of ¼-in. steel plate dropped edgewise across the crest from a height of 12 feet. 5) Subjection to 10,000 volts of electricity for 1 min., wet and dry. 6) Exposure to a ½-in. Bunsen flame during one complete rotation of the helmet in 40 seconds.

PLASTICS PRODUCTS



Pies, cakes, casseroles, and other hot dishes can be removed from a hot oven safely with a scissors-like lifter. The lifter handles, molded of Lustrex styrene, are long enough so that the cook can remove hot dishes without bending down to the oven and without putting her hand into the hot oven. Notches on handles fit around pot lid knobs so that lids can be lifted off hot pots. Lifter sold by Brown & Rice Mfg. Co., 46 Mercantile Pl., Pasadena 1, Calif.

Learning the touch system of typewriting is greatly simplified by the Type-N-Guide, which erects fences between the various finger groups so that each finger will stay where it belongs. The guide strips which fit between the keys are made of Lumarith cellulose acetate. They are beaded on the back edge so that they can slide into slots in a metal strip which fits in back of the keyboard. The plastic strips prevent students from using the wrong fingers at any time and thus prevent the formation of bad typing habits. The typing guide is manufactured by Type-N-Guide, Inc., 522 Fifth Ave., New York 18, N. Y.

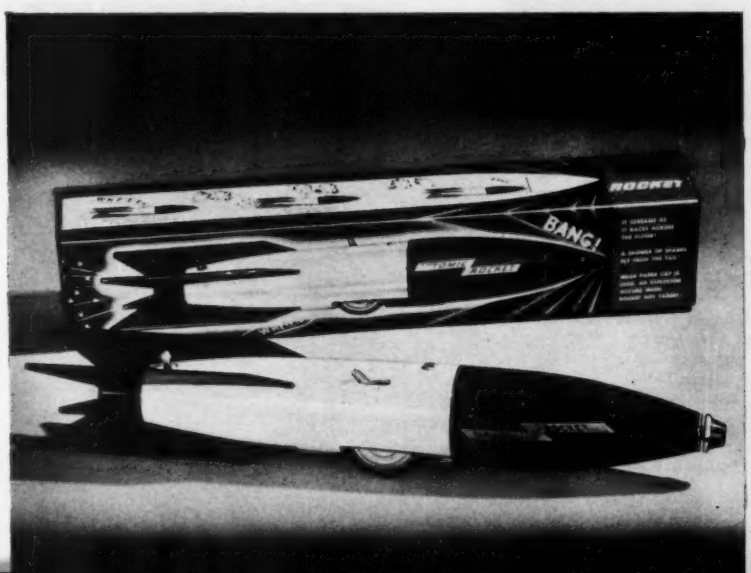
Colorful, permanently-inflated Easter eggs are fabricated of vinyl film, then decorated with two-color designs. The eggs are inflated during manufacture and have no valves. They eliminate the use of messy dyes at Easter time and can be used through the year as crib, beach, or bathtub toys. Six eggs are packed in a cellophane bag. Eggs are made by Clarvan Corp., 250 N. Water St., Milwaukee, Wis.

Handles fabricated of luminous cellulose acetate sheet make these pocket knives easy to locate in the dark. The handles glow brightly for several hours after being exposed to light. Spook Knife has single blade. Camp-Glo Knife is multi-bladed. Both knives are manufactured by Camillus Cutlery Co., Camillus, N. Y.

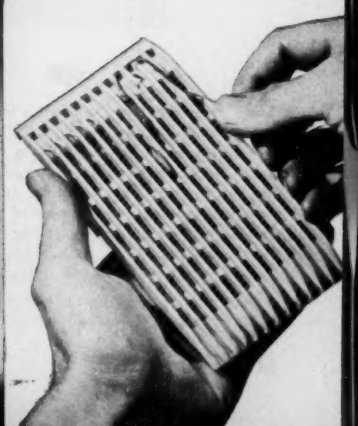
If the baby must be taken out in rainy weather, he can be given complete protection in the Baby Bunty, made of Valon vinyl film. The Bunty is a zipper-closed bag which covers the baby's body and has a hood with draw-string closure. The Bunty folds to a purse-size package. Made by Gordon Film Plastics, Inc., 21 S. Main St., Akron, Ohio

Colorful mop caps molded of Tenite I cellulose acetate hold the rayon fibers of new floor mops. The flat mop cap keeps the fibers spread for ease of use, quick drying, and compact storage. The acetate caps are molded by Plasticraft, Inc., Hot Springs, Ark., for Chalfant Broom Factory, 1911 E. Sixth Ave., Pine Bluff, Ark.

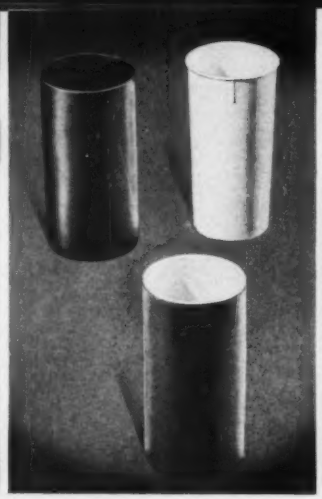
When it is wound up and the brake is released, the 'Tomic Rocket speeds along the floor with a screaming noise and sparks flying from its exhaust. When it hits the target, the rocket "explodes." Caps, such as are used in toy guns, are put between the nose of the rocket and the body to cause the explosion when the rocket hits a solid object. The rocket is 15 in. long, and its red nose, white fuselage, and transparent red tail are molded of Tenite II cellulose acetate butyrate. The parts are molded by Ger-Ell Mfg. Co., 2446 Indiana St., Chicago 16, Ill. The toy is made by Woodette Div., The Print-O-Matic Co., Inc., 14-125 Merchandise Mart, Chicago 54



Fish hooks and flies can be kept in order with their barbs safely protected on the M B Hook Saver. This device, molded of Tenite II cellulose acetate butyrate, has 12 slots, each of which has seven cross-bars over which the points of the hooks can be slipped. The leaders are then drawn around to the back and looped over the notched tips of 12 spring-operated plastic pegs. The butyrate parts are molded by King Engineering Co., Denver, Colo. The holder is manufactured by M B Mfg. Co., 2535 15th St., Denver, Colo.



When a child is learning to drink, milk is bound to be spilled. The number of accidents can be reduced with a new tumbler and base combination. The tumbler, molded of flexible Bakelite polyethylene, is easy for the child to grip. A tight-fitting molded base tends to make the tumbler slide on the table top instead of tipping when it is bumped or pushed accidentally. The odorless, tasteless tumbler is molded by Crown Plastic Corp., P. O. Box 457, Leominster, Mass.



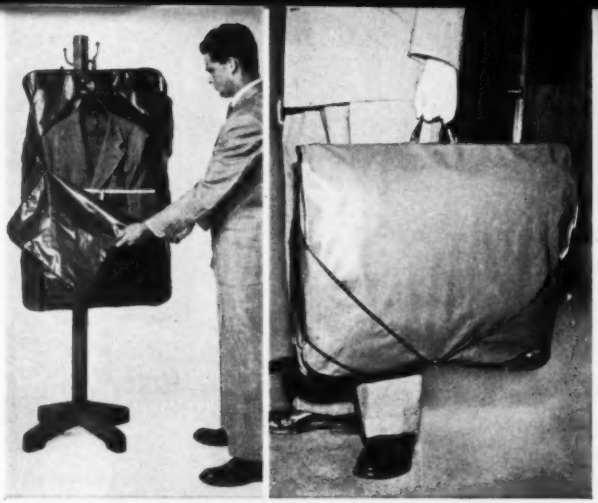
Inner shell molded of styrene snap-fits into anodized aluminum outer shell to make a double-walled tumbler. The Peacock Thermo-Tumbler retains the appearance and unbreakability of anodized aluminum tumblers, but it does not sweat or get too cold to handle comfortably. The styrene inner shell also prevents the aluminum from imparting a taste to the drink. The tumbler is manufactured by Federal Tool Corp., 3600 W. Pratt Blvd., Lincolnwood, Ill.

The Tidy-Tray can easily be attached to the side of the baby bath to give mother a handy shelf on which to put baby powder, baby oil, cotton, and other supplies. The tray also holds a Vinylite film disposal bag which lifts out so that the contents can easily be carried to the laundry. The bag can be rinsed clean or wiped with a damp cloth. The tray itself is molded of high impact styrene and can be lifted out of its supporting bracket, which remains attached to the baby bath leg. A role of tissue hangs under tray. Made by Trimble, Inc., 634 Lexington Ave., Rochester 13, N. Y.

Easily assembled bed for a doll is molded of pink Styron polystyrene. The bed measures 20 by 12 by 19 in., and two of them can be combined to form a double bunk bed. Notches in the bottom of each leg fit over lips on the top of each leg to lock the two beds together. A mattress and a pillow are packed with each bed. The Styron parts are molded by Shelley Products, Ltd., 1047 Northern Blvd., Roslyn, N. Y. The Pla-Doll bed is made by Doll Furniture Corp., 348 Irving Ave., Brooklyn, N.Y.

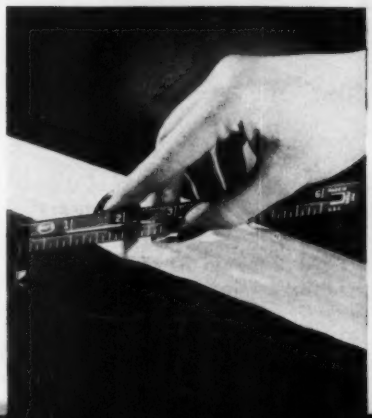
Chair seats and table cover for a bridge set are made of Ultron vinyl film. The chair cushions are comfortable foam rubber covered with the vinyl. The seats and the vinyl table cover are stain-resistant, can be cleaned with a damp cloth. They are available in smart decorator colors in sets or as individual items. Made by Plastron, Inc., 419 Fourth Ave., New York, N.Y.

PLASTICS PRODUCTS



Light weight Paklite Travel Bag is made of vinyl film. Suits or dresses are hung in the bag which is zipped closed and doubled over for carrying. The contents are thus simply folded once and will arrive at their destination unwrinkled. At home, the Paklite can be used as a garment bag. The bag is available in suit length (42 in.) or dress length (57 in.) in brown, tan, or navy blue. It is also available in various price ranges. The price depends upon the film gage, which varies from 0.006 to 0.012 inch. Manufactured by Protex Products Co., Inc., 347 Fifth Ave., New York, N. Y.

The Modern Serv-A-Drink Cooler holds enough lemonade for a children's party or can serve as a dispenser for the young sidewalk lemonade dealer. The bowl which holds the liquid is molded of clear Tenite II cellulose acetate butyrate. The paper cup dispenser is also butyrate. The bowl is molded by Perry Plastics, Inc., Erie, Pa., and the cup dispenser tube extruded by Carter Products Corp., 10225 Meech Ave., Cleveland, Ohio. The cooler is made by C. G. Wood Co., Girard, Pa.



The Tailor-ette, molded of Bakelite styrene, helps home sewers perform a variety of measuring and marking tasks. It can be used to space and line up buttons and button holes or to measure and mark hems, ruffles, pleats, or tucks. It can also be used for measuring knitting. Tailor-ette is made by Evans & Co., 57 Branford St., Newark, N. J., and distributed by John Dritz & Sons, 1115 Broadway, New York 10, N. Y.

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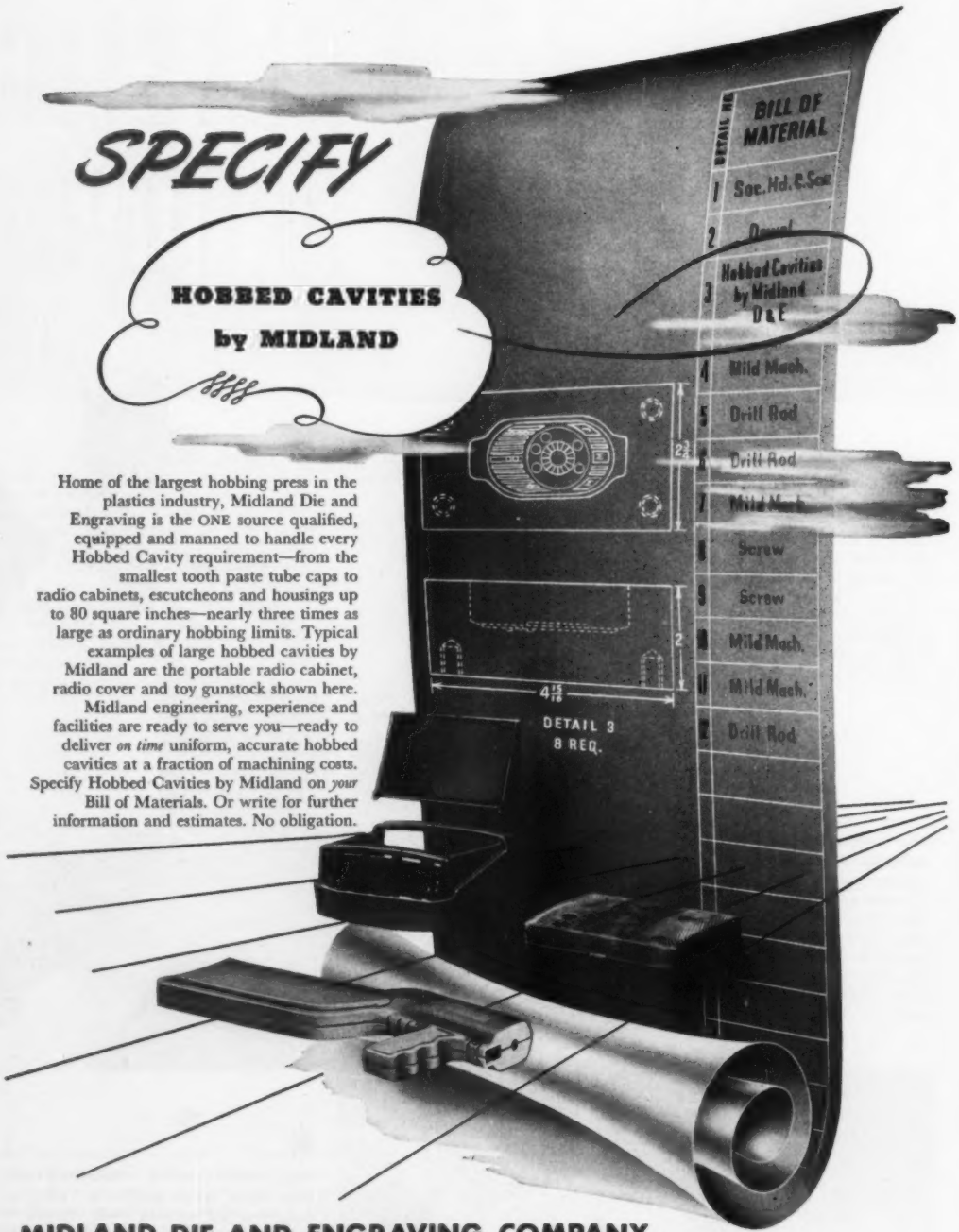

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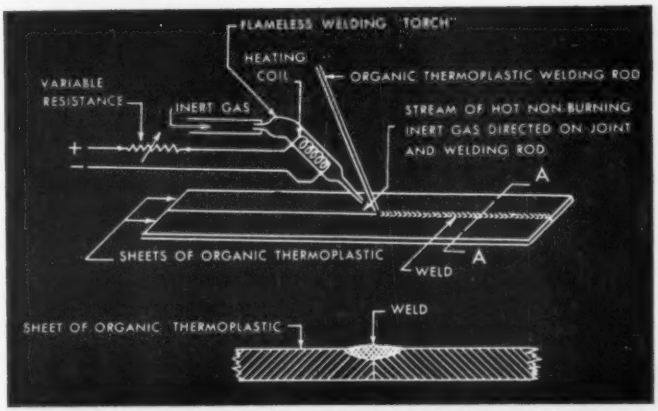
Hot Gas Welding of Plastics

by J. A. NEUMANN†

Public knowledge of the welding of plastics dates back to 1937, when R. C. Reinhardt of The Dow Chemical Co., Midland, Mich., was issued patent No. 2,220,545, which was later licensed to American Agile Corp. This patent described a method for welding thermoplastics using a hot gas welding gun. In 1943, patent No. 2,367,725, granted to Udylite Corp., Detroit, Mich., covered the use of butt weld straps and a roller for smoothing the weld. Saran was the first plastic to be welded in the United States.



1—Sketch redrawn from patent on hot-gas welding gun for use on plastics shows one method of heating inert gas. At bottom: Cross-section of a weld

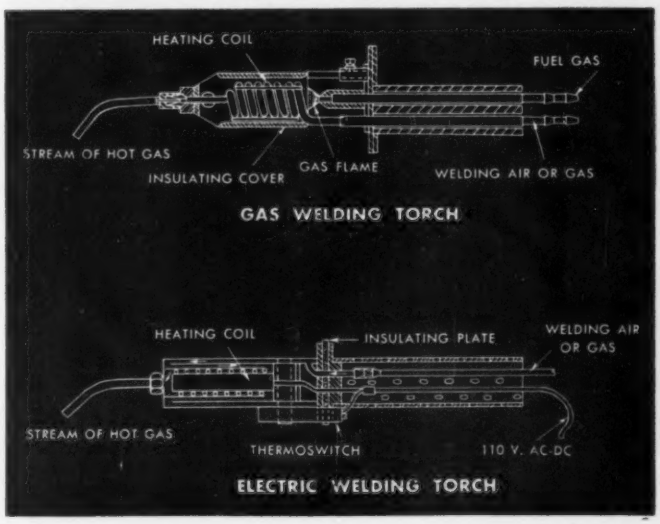
THROUGH the process of welding, it becomes possible to extend the size of all-plastic assemblies to an almost infinite degree. Welding also offers a means of producing shapes not otherwise obtainable, as well as of repairing and rebuilding damaged thermoplastic components.

Bases of plastic welding are the facts that thermoplastics soften and can be brought to coalescence when heated and that the original rigidity is regained upon cooling. Among the thermoplastics which have been found weldable, the first which acquired importance was the polyvinyl chloride group of plastics in this country, while in England it was polyethylene.

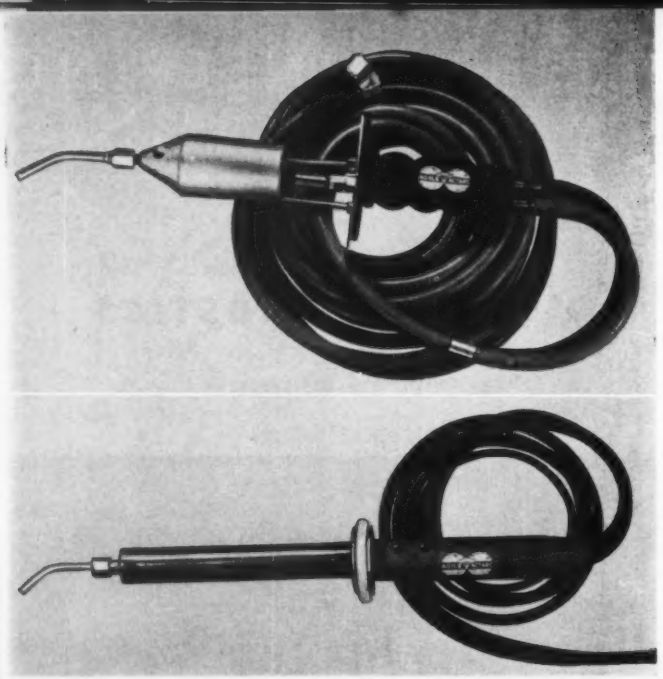
Equipment

The equipment used in welding plastics consists of a hot-gas or "flameless" torch, pressure regulator, and filler rod. The torch described in Reinhardt's patent is

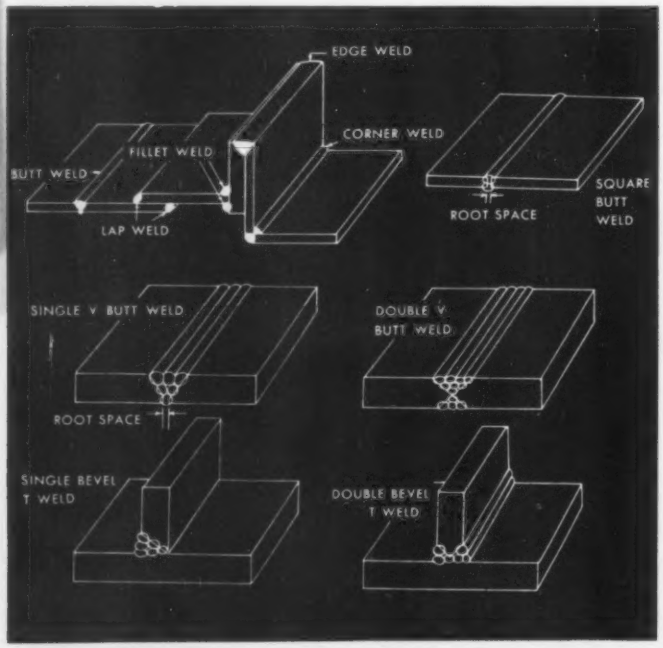
2—Welding torches may be heated by either electricity or combustible gas. Air or inert gas to be heated is fed to torch under 5 to 10 p.s.i. pressure



*Reg. U. S. Pat. Office.
†Director of Research, American Agile Corp., Cleveland, Ohio.



3—Nozzles of hot-gas welding guns—gas operated at top and electric at bottom—are usually bent slightly, but straight tips are used on some jobs



4—In some types of welds for plastic sheets—fillet and lap, for example—edges are square; in others, single or double bevels may be more desirable

shown diagramatically in Fig. 1. Present-day torches are heated by either gas or electricity, and a schematic view of the two types is given in Fig. 2. The gas welding torch permits the regulation of the temperature of the stream of hot gas or air by varying the flame which heats the coil. The electric torch is heat-regulated by a thermo-switch. The temperature of the stream of hot gas may be further regulated through the gas pressure and also by varying the distance between the tip of the torch and the weld piece. In any case, the temperature at the orifice should be between 400 and 600° F.

With either type of gun, and whether a neutral gas or compressed air is used as the hot welding gas, a pressure regulator is necessary to control the flow of gas through the gun to the weld piece. Such a regulator should permit a continuous flow at a constant pressure of 5 to 10 p.s.i. Approximately 2 to 10 cu. ft. of heated gas are used per minute of welding time. Should compressed air be used as the hot gas, a filter is essential to remove moisture and oil from the air. The combination of filter and regulator, used widely in spraying work, suits this purpose well and is available without difficulty.

The welding filler rod should be of the same material as the plastic to be welded. Sometimes a rod slightly more plasticized than the material to be welded is advantageous because it gives somewhat greater control over the weld contour. However, welds made with plasticized filler rods usually show a slight reduction in chemical resistance and a small loss of dielectric strength. Diameter of the filler rod varies from $\frac{1}{16}$ to $\frac{3}{16}$ in., the size depending upon the size and type of weld desired, ease of access to the joint, and size of gun. A round rod is preferred since it makes for a smooth and even deposit; also, its diameter should be constant throughout its length to permit application of constant pressure and to produce a uniform deposit.

The welding guns described have replaceable tips so that the orifice can be varied from $\frac{1}{8}$ to $\frac{1}{4}$ inch. As shown in Fig. 3, there is a slight bend near the tip of the gun nozzle to provide a more convenient weld-

ing position during operation. For some particular welding jobs, however, a straight tip may be more desirable.

Types of Weld

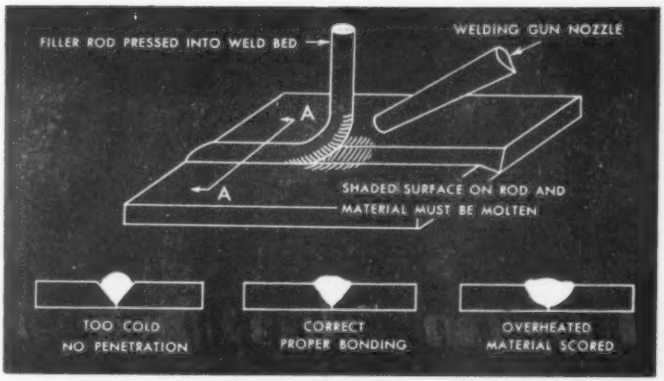
Plastic welds resemble the types produced by electric arc welding. For the fillet weld, no preparation is needed. For the butt weld, the two pieces are bevelled in the manner used in arc welding, but at a smaller angle, namely 60 to 80°, and with no sharp edges. Such bevelling may be performed by sawing, filing, or grinding. It is important that the prepared surfaces be clean. Roughening the surfaces with a scraper will improve the welded bond. When a butt weld is made, a sealing run on the reverse side of the weld insures higher tensile strength.

Figure 4 shows the preparation and the form of the weld. Considerations that govern decisions as to types of welds to be used in arc welding are also applicable to plastic welding.

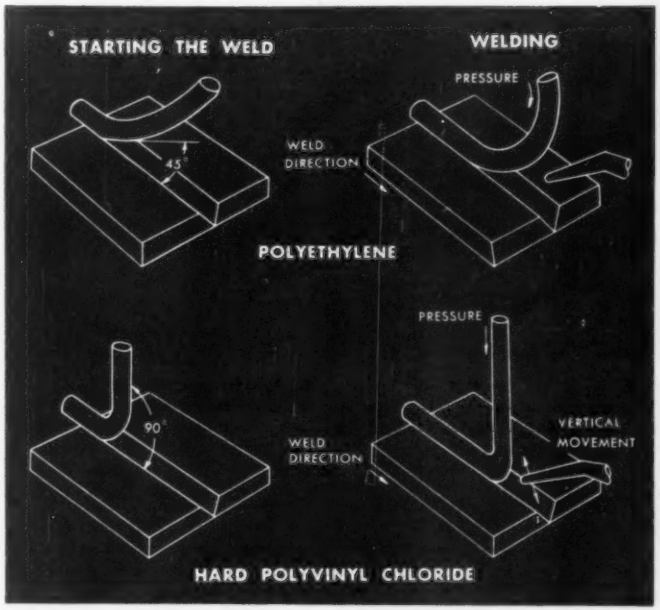
Welding Process

One essential difference between metal welding and plastics welding lies in the kind of joining that takes place between filler rod and parent material. Complete fusion of the two is characteristic of arc welding. With plastics, a simple bonding process takes place between filler rod and material, since only the actual meeting surfaces melt; the other parts, such as the center of the rod, remain relatively unaffected and rigid. The slight pressure that is applied to force the filler rod into its "bed" (a pressure reminiscent of the old blacksmith's method of joining two pieces of metal, or the pressure needed in resistance welding) has the effect of combining the melted surfaces into one homogeneous mass. In this manner, a bonded, integral weld is produced.

In order to produce uniform coalescence it is essential that the torch be used to pre-heat the surfaces or edges to be welded as well as the filler rod before insertion into the weld. The filler rod cannot adhere to the parent material if the surfaces have not been sufficiently pre-heated and melted. Overheating, on the other hand, causes a darkening of the material and too much sub-surface melting.



5—Edges to be welded, as well as surface of filler rod, must be pre-heated before rod is pressed into weld bed. At bottom: Sections through welded sheets



6—Pressure must be applied to the filler rod during plastics welding, but the amount of pressure and the direction of application is not always the same. Undercutting is prevented by weaving the hot gas stream as work progresses

Figure 5 shows the results when the welding process is correctly and incorrectly carried out in respect to heat application. The preliminary heating of the filler rod should be confined to an area of about ½ in. from the tip of the rod, as shown in Fig. 6. If when welding the hard polyvinyl chlorides the surface of the material is too liquid, there will be a tendency for the deposited rod to slide as welding proceeds and to raise itself from the weld during cooling.

Two variable factors in the process make it possible to adjust the process to the particular properties of the kind of plastic to be welded. These factors are the amount and kind of pressure applied to the filler

7—Examples of welding of polyethylene by the hot-gas torch method. The fume duct at left was fabricated from cast tubes, the square duct at lower left center from sheets. Bottoms and other parts of containers were welded

8—Welding the flange on a polyethylene liner for an acid tank

rod and angle at which the welding takes place. For welding polyvinyl chlorides, the filler rod should be almost perpendicular to the weld piece (see Fig. 6), while for the softer polyethylenes the more advantageous angle is 45°.

A slight weaving motion of the hot gas stream prevents under-cutting. Should failures occur due to underheating or overheating, such affected parts of the weld must be removed before welding continues. With multi-layer welds, which begin to be used with material thicknesses greater than 5/32 in., the single beads should be deposited in such a manner that continuous contours are obtained. A final sealing run is used whenever possible.

The easiest manner of welding is, of course, in the downhand position, yet welding in a vertical or overhead position presents no difficulties as long as the freedom of manual movement remains unimpaired.

To determine the soundness of the weld and the thoroughness of surface bonding, the operator may attempt to pull the end of the welding rod from the welded piece. It is important that such a test be made only after the weld has cooled completely. With a good weld the filler rod should tear off at the end of the weld; a poorly made weld will allow the rod to be pulled out of its bed.

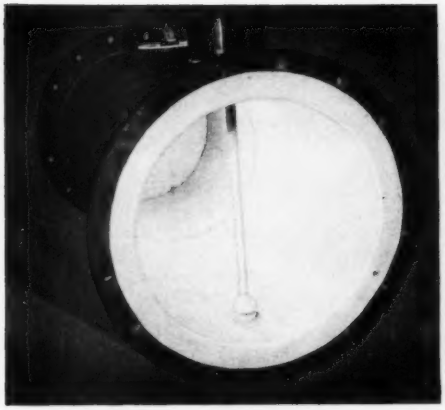
Welding Costs

The costs for plastic welding can in general be compared with those for metal welding, except that electrical or gas consumption is appreciably lower because plastics have a melting point which is radically lower than welding rod for metals. Similarly, the material used in plastic welding filler rod and the neutral gas—usually nitrogen—are of relatively low cost.

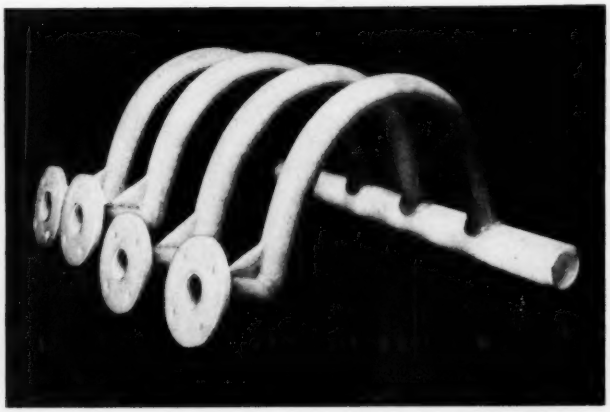
Table I gives basic data for welding polyethylene. With an approximate 10% increase in welding time,

Table I—Data for Gas Welding of Polyethylene. (All dimensions in inches)

Joint form	*Material thickness*	*Root space*	*Rod size*	*Gas consumption, cu. ft.*	*Nozzle diam.*	*Welding time per ft.*
Butt	3/32–1/8	1/32–1/16	3/32	2.6	1/8	2–3 min.
Single V	1/8–5/32	1/16–3/32	1/8–5/32	2.8	5/32	3–5 min.
Double V	1/4–3/8	1/16–3/32	5/32–3/16	3.2	1/4	8–10 min.
Lap	3/32–1/8	.....	1/8–5/32	3.6	5/32	6–8 min.
Lap	5/32–3/16	.....	5/32–3/16	4.2	1/4	8–10 min.



9—Fabrication of 9-ft. long tank liner was made possible by hot-gas welding



10—Upper right: Manifold with welded joints, including those at the flanges

the same table may be applied to welding polyvinyl chlorides.

Testing the Weld

Faults arising from overheating, insufficient bonding, porosity in filler rod, poor starts, and failures in the roots will affect the quality of the weld. Most of these faults can be detected by the manual test described above or by visual inspection, either under a spotlight, with a magnifying lens, or by holding the weld against light. Since the faults are largely due to inexperience of operators, they can be overcome with adequate training.

The tensile strength of the welded plastic in butt welds averages 90% of the parent tensile strength. The figures for fillet welds are somewhat lower, but by means of reinforcements sufficient strength may be obtained in every case. A weld does not attain its full strength immediately after the weld has been made, but only after 2 to 6 hr. have elapsed, depending upon the size of material and type of weld. Sometimes a creeping action or deformation becomes noticeable only several hours after welding.

Training of Welders

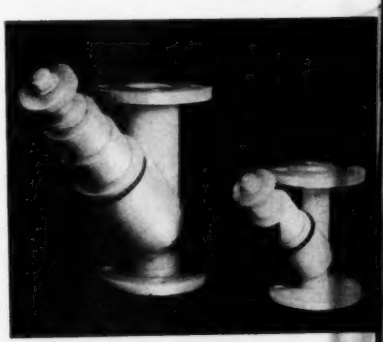
The close resemblance between the welding of metals and the welding of plastics makes it possible for welders familiar with the former technique to master this new skill with little difficulty. The less extreme conditions in plastic welding —virtual absence of fumes, unobstructed visibility, and lower temperatures — make for proficiency after a reasonable practice period. Training programs resembling those customary for arc welding may be instituted without encountering unusual difficulties.

In Germany, where plastics welding was extensively applied during World War II to weld and repair acrylic domes on airplanes, a training school was established shortly before the outbreak of the war. The repair shops were equipped with hot air guns and manned by trained welders who developed high proficiency in repairing and restoring broken parts of these transparent plastics.

Applications

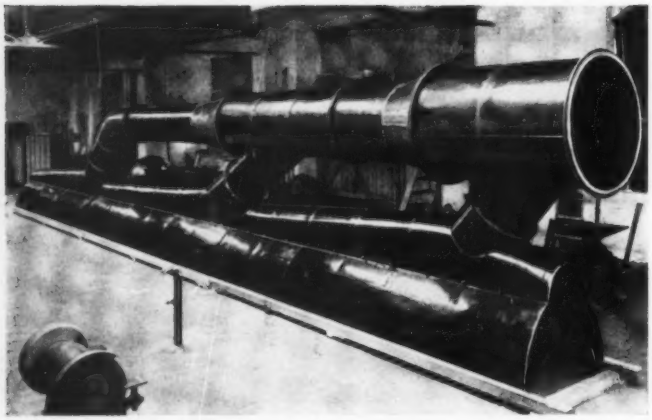
Successful uses for welded plastics have been found in the chemical and food industries, in laundries and breweries, and wherever acids and strong alkalis are present. Buckets, pipes, vats, and tank linings are efficiently and inexpensively fabricated by welding. For the manufacture of standard products, welding jigs similar to those used in the arc welding industry may be set up.

Some of the more general applications of plastics welding are illustrated here. Figure 7 shows fabricated polyethylene as exhibited by Du Pont at the 1950 National Plastics Exposition in Chicago. These parts were manufactured by Ameri-

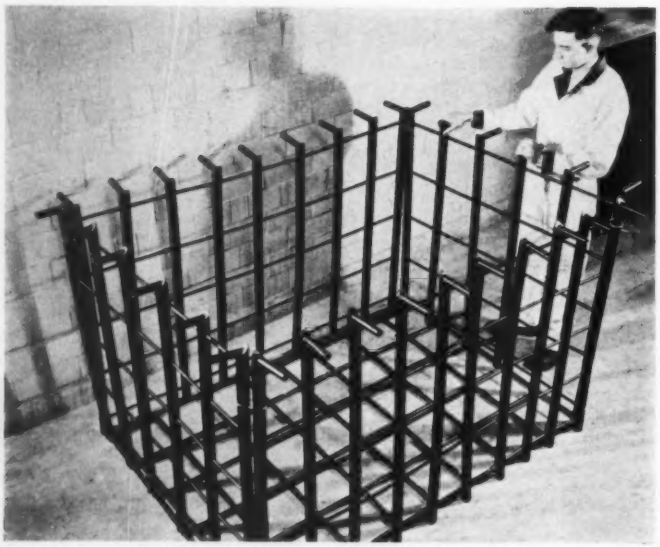


11—Two sizes of angle valves fabricated with all-welded parts

12—Correct operating position for using gas-heated welding gun



13—Hard polyvinyl chloride can now be fabricated into huge assemblies, as evidenced by this gigantic fume duct made in Germany by hot-gas gun welding



14—Saran, first plastic to be welded in the United States, is used in this large plating rack where its resistance to corrosion is a necessary property

can Agile Corp. At the extreme left is a fume duct, 24 in. in diameter and reducing to 12 inches. The tubes were cast and then welded together. Next to it is a square duct line, 18 by 6 in. in cross section, fabricated of polyethylene sheets 5/32 in. thick. The connecting 90° angle piece is a typical example of a plastic welding application. In the center of the picture is a polyethylene crock, 24 in. in diameter with 1-in. walls, which replaces the conventional stoneware crock with a saving in weight of more than 300 percent. The bottom of the crock is cut from 1-in. polyethylene sheet, then welded to the cylinder. The weld is reinforced with a ring of the same plastic, which is also welded to the side and bottom. The safety jugs are for handling acids, and the acid bottles are of welded construction with a molded bottom and cup. Since the above-mentioned exposition, these various products have become widely used in industry.

An acid-tank liner 1/8 in. thick for wooden vats, used in the plating industry, is shown in Fig. 8. The lining is 4 by 3 by 3 feet. The operator is shown making a finishing run on the flange, using an electric gun. Figure 9 pictures another tank lining, 9 ft. long and 2 ft. in diameter, produced by Rediweld Corp. of England. The manifold with welded flanges in Fig. 10 and the two wholly welded angle valves 1 and 1½ in. in diameter (Fig. 11), are also produced by Rediweld Corp.

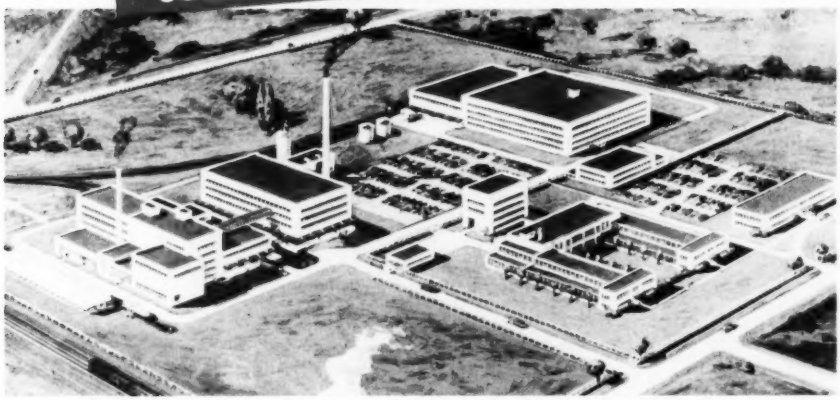
Figure 12 shows the flanging operation on 5 in. tubing with a gas-heated welding gun. This picture also illustrates the correct position of the gun. Such tubing has been used in the mining industry. Figure 13 shows a fume duct made of hard polyvinyl chloride by Dynamit-Actien-Gesellschaft of Troisdorf, Germany. This is probably the largest fabricated piece of plastic in existence. The plating rack in Fig. 14 is made of saran by The Dow Chemical Co.

For electric uses, welded plastic insulators and safety devices are making their appearance. The low dielectric losses, the high electric breakdown strength, and the light weight of plastics are likely to contribute to the widespread use of such constructions.

Plastic welding grew in importance and usefulness as the availability of large plastic sheets, tubes, and molded sections increased. The introduction of versatile polyethylene in sheets of 36 by 60 in., and in tubes up to 6 in. in diameter in extruded form and over 6 in. in cast form, and in all thicknesses, made possible a rapid, parallel development of plastic welding; now, with a widening of use of hard polyvinyl chlorides, the opportunities of intelligent applications are constantly multiplying.

The installation of plastic welding equipment is inexpensive and rewarding by its ready adaptability to mass-producing plastic ware on the one hand and to the manufacture of all sorts of custom-built products on the other.

SOMETHING NEW IS BEING ADDED.....



Plant facilities completed 1947 now being enlarged with a new Plaskon Alkyd molding compound plant

because week after week, month after month, Plaskon Alkyd gains in acceptance and use

• With Plaskon Alkyd delivering superior performance to an ever growing list of proved commercial applications, resulting in consistently increasing usage, a new plant is required to assure that future supply will keep step with demand. High-speed low-pressure molding with Plaskon Alkyd has become a reality. And the superior characteristics in molded form of this thermosetting material—arc resistance, heat resistance, dimensional stability—are being recognized more widely every day.

Manufacturers of electrical control devices, makers of electronic components and designers of other industrial parts are fast realizing the cost and performance advantages of this modern plastic.

The Plaskon organization is ready to discuss how your company can benefit through the availability of this successful new molding compound.

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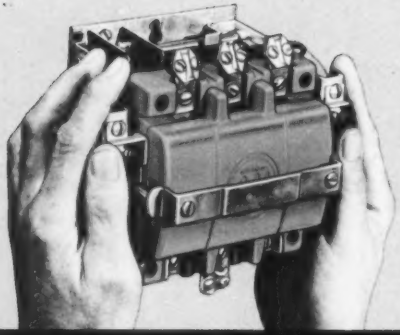
PLASKON®
ALKYDS



Grueling tests proved thermosetting Plaskon Alkyd the best choice in plastics for bases and hoods of the extremely compact magnetic starters recently developed by The Arrow-Hart & Hegeman Electric Company, Hartford, Connecticut.

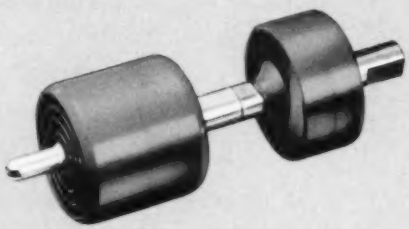
NUMBER 5 IN A SERIES OF BUSINESS-GETTING CAMPAIGNS TO HELP COMPRESSION MOLDERS INCREASE SALES IN KEY MARKETS

Electronically speaking . .

Spurred by television and increasing industrial applications, electronics has become one of the nation's fastest growing industries. Here's a big field for the *right* plastic. And Plaskon Alkyd is that *right* plastic—proved so in many diversified electronic applications.

The high resistance of Plaskon Alkyd to arcing and its high dielectric strength, mechanical strength, dimensional stability and moisture resistance help make electronic products perform better—last longer. And plastic parts for electronic equipment can be molded so much faster with quick-curing Plaskon Alkyd no manufacturer can afford to miss this opportunity.

Selected for its outstanding resistance to electrical arcing and other unusual electrical properties, Plaskon Alkyd cut the cost of molded brackets for Emerson television sets by 50%. Brackets molded for Emerson by Plastimold, Inc., Attleboro, Mass.



Because it met many rigid requirements with flying colors, Plaskon Alkyd was chosen for the filter capacitors for high voltage supply produced by Centralab Division of Globe-Union Corp., Milwaukee.

Use of quick-curing Plaskon Alkyd in parts for its Sangamo Time Switch gave the Sangamo Electric Company, Springfield, Illinois, a faster molding cycle which led to a new high rate of production.

Terminal plate of Sangamo A.C. electrolytic motor starting capacitor is molded from Plaskon Alkyd at record high speed by The Sangamo Electric Company, Springfield, Illinois.

. it's Plaskon Alkyd preferred!

Here is the impressive story Plaskon is bringing to the electronics industry in national magazine advertising, in direct mail and in publicity in newspapers and trade journals. It's a continuing campaign—the fifth in Plaskon's current series of business-getting campaigns designed to help our compression molder customers obtain additional business in key markets. Tie in with it now—for *profitable* results.

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Demands for precision molded television parts were met by quick-curing Plaskon Alkyd. "The Standard Tuner" is made by Standard Coil Products Company, Chicago, Illinois. Parts molded by Wilcox Plastics, Los Angeles; Mayfair Molded Products Co., Chicago; and Trans-Matic Plastics Company, Chicago.

A PLUG FOR beauty

Monowatt adds a plug for beauty to electrical fixtures and appliances with their new, ingenious line of Quick Clamp wiring plugs.
They're light and bright to harmonize with both modern and traditional decorating schemes.
And they're made with Plaskon Urea Ivory.

Monowatt chose Plaskon Urea because it is a thermosetting colorful plastic which is approved by Underwriters' Laboratories, Inc.
What's more, Plaskon Urea has excellent moldability, highly satisfactory insulating qualities, high arc resistance and dependable strength.

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We will welcome your request for descriptive literature.

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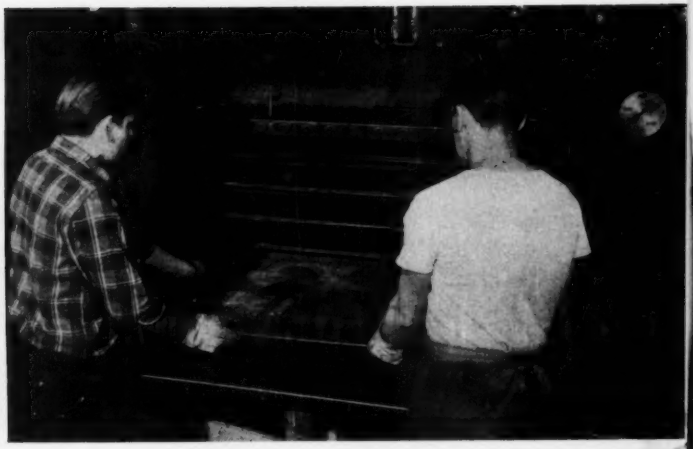
PHOTOS THIS PAGE COURTESY ACADIA SYNTHETIC PRODUCTS DIV.

Polythylene granules are spread on lower half of mold to assure uniform flow and thickness



Closed mold being slid between pair of cored platens of 38-in. press. Up to five sheets can be compression molded in multi-platen press at one time

Compression Molding Thermoplastics

How multi-platen presses and special molds are used to produce strain-free sheets with good dimensional stability

by D. L. STANLEY

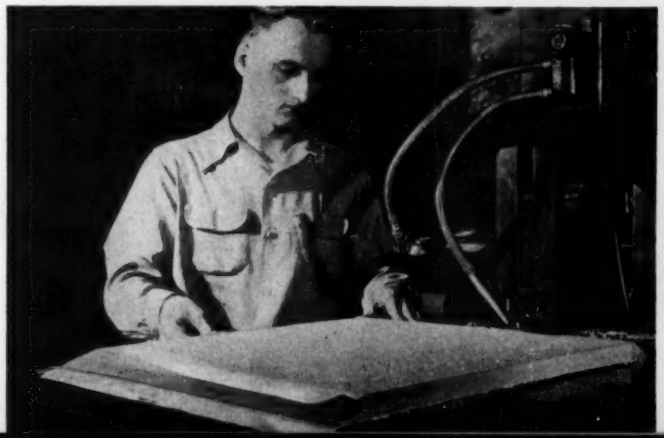
THERE are several methods of producing sheet stock from thermoplastic materials. Sheet can be made by calendering, extruding, casting, and skiving from thick blocks, and also by compression molding. Certain physical properties of sheeting vary considerably according to the manufacturing method used. Also, where a strain-free sheet having excellent dimensional stability and high heat resistance is required, Acadia Synthetic Products Div., Western Felt Works, Chicago, Ill., has found that compression molding is the best method of producing it. This company first compression molded saran sheet in 1942, and since then has expanded its plant and know-how so that today it can produce sheets up to 36 in. square and up to 1 in. thick from practically any available thermoplastic.

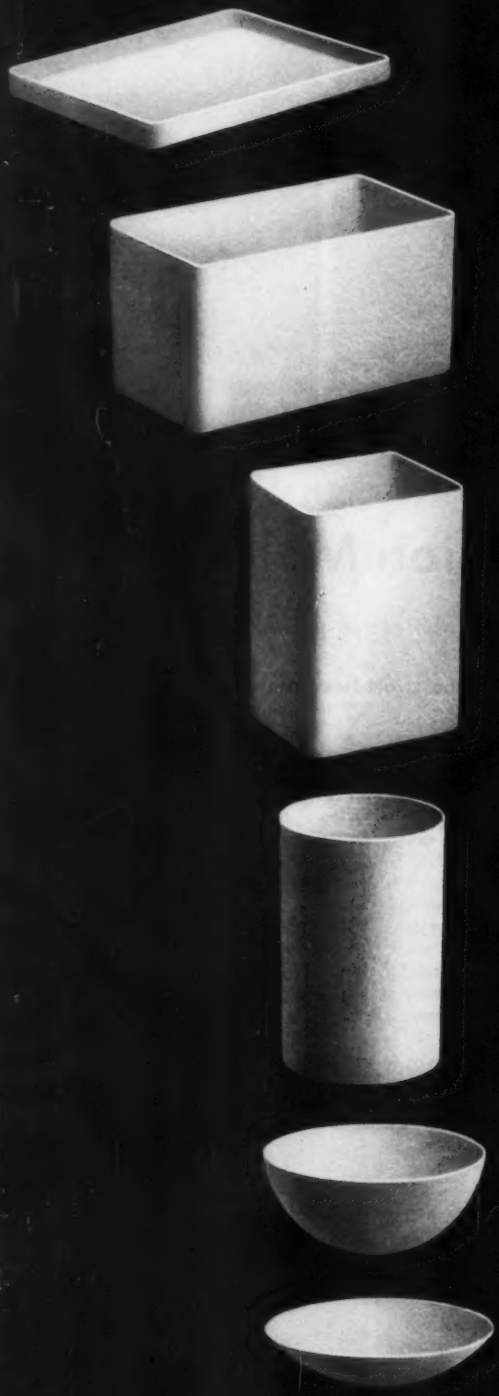
The press equipment used for molding sheet is of the multi-platen type, similar to that used in molding high pressure laminates. Each platen is cored and separately connected to a source of high pressure steam, as well as of cooling water, which are used alternately for heating and chilling the platens. The molds themselves are not cored but heated and cooled by conduction.

The sheet molds are comparatively thin and are made with a depressed area the size of the sheet required and as deep as the thickness of the sheet to be produced.

(*Continued on p. 110*)

Trimming a 1-in. thick molded styrene sheet. Sheets are covered with masking tape as soon as they are molded to protect their highly polished surfaces





tote box
tray
shipping container
trough
instrument case

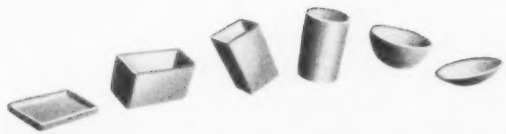
tool chest
foot locker
refrigerator locker
laundry basket
machine housings
machine guards
truck body
trailer body

luggage
laundry hamper
medicine cabinet
file cabinet
telephone booth

waste basket
garbage pail
kitchen cannisters
ducts
rods

helmets
radomes
shelters
structural panels

boat hulls
sinks
baby carriages
light reflectors



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PHOTOS COURTESY ACADIA SYNTHETIC PRODUCTS DIV.

Black vinyl sheet coming off mold which imparts polished surface to the plastic

Silicone rings can be compression molded in various shapes. Final cure is accomplished in an oven at varied time intervals depending upon the formulation

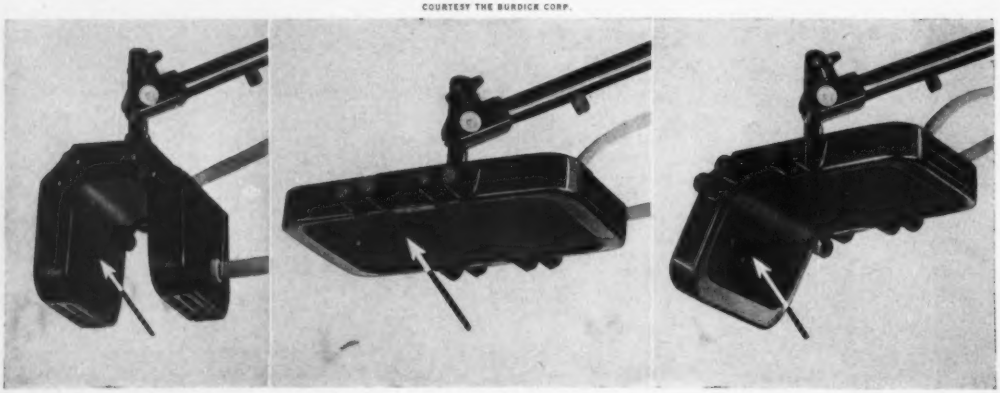
The molding compound used is ground to as fine a granulation as possible. This is necessary because a molding material charge of large granules or pellets tends to entrap air and cause bubbles in the finished sheet.

In the molding operation the previously weighed charge of material is spread by hand as uniformly as possible over most of the area of the lower half of the mold, with some room left around the margins to permit a degree of flow. The upper half of the mold is then placed in position on the lower half and the entire mold is slid in between a pair of cored platens. After each opening in the press has its mold in place and the platens have been brought up to temperature, the press is closed.

A pressure of 1000 p.s.i. is sufficient for most materials although Teflon may require as high as 2000 p.s.i. Temperature requirements for certain thermoplastics differ to some extent, but the maximum temperature to which the molds must be raised is about 360° F. Shortly after the molds have reached this temperature the material has completely melted and filled out the mold. The steam is then turned off and the cooling water circulated through the cored platens until the

Face of diathermy applicator must flex as parts are adjusted to body contours. Compression molded polyethylene sheet (arrows), provides flexible, continuous surface—regardless of position—which shows no cracking or shrinkage with age

COURTESY THE BURDICK CORP.



molds cool to a temperature of from 100 to 200° F. depending upon the material being molded. After the press is opened, the molds removed, and the sheets unloaded, the molds and press are ready for another cycle.

After the flash is trimmed from the sheets, they are placed in an annealing oven unless, because of the nature of the material being molded, the sheets have been annealed while still in the mold. Such mold annealing is accomplished by lengthening the cooling cycle to cool the material slowly.

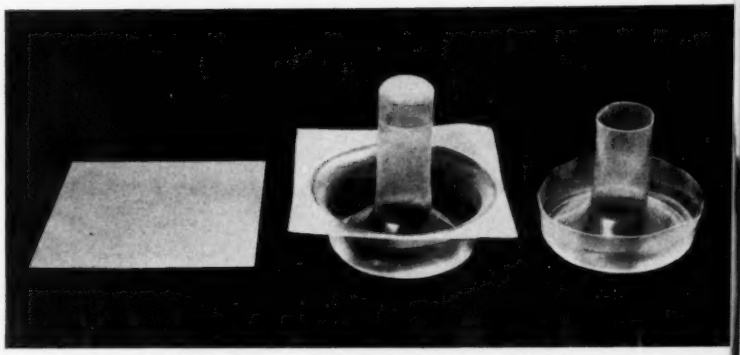
Where the finished piece must withstand high heat and the shrinkage problem is severe, "after-annealing" is generally required. This operation consists of holding the sheets in an elevated temperature oven for varying periods of time depending upon material formulation.

In addition to the production of sheet, Acadia also compression molds certain forms and shapes from thermoplastics. In the case of silicone, a number of sizes of "O" rings and lip seals are compression molded. After molding it is necessary that this material be cured for varying lengths of time according to the formulation of silicone used. This time may be as short as 4 hr. or as long as 24 hours. In this curing operation the temperature of the oven is slowly raised to the top temperature required and the pieces are taken out of the curing oven at the top temperature.

The company also molds a silicone-rubber sponge material. The foaming is accomplished by using a special formulation of silicone and either accelerating curing which causes gas present in the material to produce a cellular structure or adding a blowing agent. In the latter process, Unicel (Du Pont) is introduced in powder form during a milling operation. Approximately 1% of Unicel is all that is required. The compounded material is taken directly from the mill and molded to the required thickness.

Uses for Molded Sheets

Certain applications of Acadia's molded sheets back up the company's claims of superior dimensional stability and heat resistance. For example, Lamicoid Fabricators, Inc., Chicago, Ill., purchases 6 by 6 in. square 0.050-in. thick polyethylene compression molded sheet for the production of a special type of coil insulator for television sets. A complicated drawing operation is used to produce this insulator in its required funnel shape from the square flat sheet. According to Lamicoid, polyethylene sheet made by a method other than compression molding did not draw smoothly and uniformly enough for this particular job, with its exacting dimensional requirements. Also, the rejection rate was high because of tears and thin spots. It is reported that no difficulty is encountered with compression molded sheets and that they draw easily to the uniform thickness required for insulation against the high voltages developed in television sets.



COURTESY LAMICOID FABRICATORS, INC.

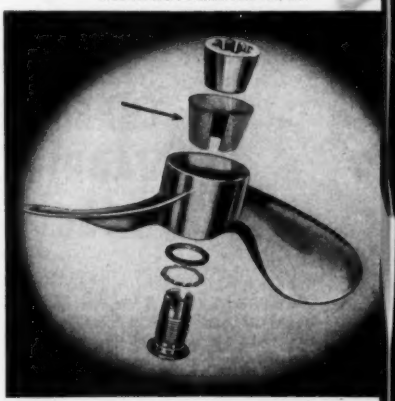
Coil insulators for T.V. sets are made of 0.05-in. compression molded polyethylene sheet (left) which is drawn to shape (center), trimmed (right)

Another application for compression molded plastic sheet is found in the face for a contour applicator used in a diathermy machine. Previous attempts had been made by the manufacturer, The Burdick Corp., Milton, Wis., to use polyethylene sheet because it was considered ideal for the purpose. The first sheets used shrank badly, but specially annealed compression molded sheet solved the problem and such diathermy units have been in service several years with no shrinkage or cracking discernible in the face.

Compression molded saran sheet is used in the clutch of a new outboard motor manufactured by Scott-Atwater Mfg. Co., Inc., Minneapolis, Minn. This clutch was designed to replace the so-called shear pin used to protect the propeller and the driving mechanism by breaking when the propeller strikes an underwater object, and thus permitting the motor to run free without further damage. The new slip clutch, incorporating a strip of compression molded saran sheet, is built into the propeller drive assembly so that it won't slip at any normal speed but will slip and thus prevent damage to the motor when the propeller strikes an obstruction. Many materials were tried for this application but compression molded saran sheet proved to be the ideal material because it is extremely tough, is resistant to abrasion, and has the proper coefficient of friction.

Toughness, abrasion resistance make compression molded saran suitable for friction element (arrow) in outboard motor clutch

COURTESY SCOTT-ATWATER MFG. CO., INC.



✱ Adding machine housing molded of medium impact Durez phenolic plastic as fortified with Claremont Cotton Flock Filler. Photo: courtesy of Durez Plastics & Chemicals, Inc. Project: machine case for L. C. Smith & Corona Typewriters, Inc. Molder: Northern Industrial Chemical Co.

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Epoxy Resins in Glass-Cloth Laminates

by I. SILVER† and H. B. ATKINSON, Jr.†

New resin formulations involving epoxy resins have been developed for use in the lamination of glass cloth. Experimental formulations of these resins when cross-linked with amine-catalyst have resulted in laminates with exceptional physical properties. Laminates have been made with ECC 181-114 glass cloth having ultimate flexural strengths as high as 85,000 p.s.i. and flexural moduli of 4 x 10^6 p.s.i. Their tensile and compressive properties are also higher than those usually obtained with polyester resins, although Izod impact values are slightly lower. Their dielectric constants and dissipation factors are higher than those of polyester laminates, and the moisture absorption properties and hardness are in the same order for both types of resins. These data indicate that this new epoxy formulation has definite possibilities for use where lightweight, high-strength materials are needed.

VERY few factual data are currently available on the pertinent basic factors affecting the strength properties of low-pressure glass-cloth laminates. At the Naval Ordnance Laboratory, consideration has been given to a number of these factors including the improvement of the adhesion of the glass cloth to the resin and the study of the effect of stresses in the laminate resulting from shrinkage of the resin on cure. It has been demonstrated that improvement in the physical properties, and in particular the flexural strength, may be attained by increasing the adhesion of the resin to the cloth by pretreating the glass cloth or by selecting or developing suitable resin formulations. Improvements in flexural strengths have been achieved at this laboratory by employing slow cures at low temperatures to minimize stresses brought about as the result of shrinkage.

Unsaturated polyesters have heretofore found most general use as resin binders in low-pressure glass-cloth laminates. Although these resins possess many worthwhile physical and electrical properties, it is doubtful whether the optimum mechanical strength possible from the combination of resins with glass-cloth reinforcements has always been fully realized with polyesters. This may possibly be due to a deficiency in adhesion of the resin to the glass cloth resulting from improper wetting of the cloth and indirectly to the shrinkage of the resin in cure. Improvements in such properties as flexural strength, stiffness, and resistance to delamination would be highly desirable for many military purposes.

In the course of investigating the properties of various resins for use in glass-cloth laminates, consideration was given to a group of epoxy resins originally recommended for use in adhesives and coatings. These resins were thought to be of interest because of their excellent adhesion to glass and small shrinkage on cure as indicated by preliminary laboratory tests.

This paper describes the steps taken in formulating a laminating resin of 100% solids content employing epoxy resins and sets forth the properties obtained by the use of these resins in the fabrication of glass-cloth laminates.

Materials

The epoxy resins employed are those identified by Shell Chemical Corp. as Epon resins and in most cases are basically either condensation products of bisphenol-A and epichlorohydrin or of glycerol and epichlorohydrin, both types being catalyzed mainly by amino-derivatives to form cross-linked resins. These resins are available in several forms varying from a viscous liquid to a solid resin with a melting point of 145° C. Table I lists the Epon resins employed in this investigation and a number of their essential properties. The glycidyl allyl ether is a reactive solvent which enters into the reaction and performs a function similar to that of styrene in polyester resins. Generalized equations for the condensation and polymerization reactions are shown in Fig. 1.

The glass cloth employed consists of ECC-181-114 and ECC-181, both being woven glass cloths with an eight-shaft satin weave as supplied by Owens-Corning Fiberglas Corp. The ECC-181-114, as obtained, is chemically treated to increase the adhesion of the resin to the cloth. ECC-181 contains sur-

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* Reg. U. S. Pat. Office.
† Naval Ordnance Laboratory, White Oak, Md.

face lubricants which for the purposes of this experiment have been removed by a heat treatment at 800° F. for 3 hours.

Preparation of Laminates

A vacuum method was employed for impregnating the glass cloth. Laminate panels 3 in. in diameter were made by impregnating the glass cloth in an apparatus (Fig. 2) consisting of a sintered glass filter approximately 3 in. in diameter, a separatory funnel fused to a large 60° funnel, and a filtering flask. The smooth edges of the sintered glass filter and the 60° funnel were ground flat with carborundum and water so as to fit together. Ten layers of ECC-181-114 glass cloth were cut into 3-in. disks and laid up with all warp threads laid parallel on the sintered glass surface and the filter assembled to the filtering flask. The catalyzed resin was put into the separatory funnel and when the maximum vacuum had been attained, usually less than 1 mm., the stopcock in the separatory funnel was opened, and the resin was forced down into the cloth by atmospheric pressure. Approximately 1 min. was required for complete saturation of the cloth. The separatory funnel was then removed and the 10 layers of cloth taken out with a large flat spatula, laid on a previously prepared piece of sheet polyvinyl alcohol, and sealed into a bag with cellulose adhesive tape. Air trapped between the cloth and the polyvinyl alcohol was rolled out, and the panel was placed between electrically heated, water-cooled platens in a 20-ton press. Here, the panel was cured.

Laminate panels 8-in. square were made by impregnating the glass cloth in a steel chamber. The chamber was fitted with a neoprene-gasketed steel lid which could be bolted down. The cloth was cut 8 by 8 in. and laid up with all warp threads parallel on a flat plate drilled with ¼-in. diameter holes and suspended in the center of the chamber. The operation of this apparatus (Fig. 3) was similar to the small glass system. After evacuation and impregnation the cloth was removed from the chamber and laid in a polyvinyl alcohol bag, the trapped air rolled out, the bag sealed, and the resin cured by the same process as before.

Test Methods

The physical tests made on the standard panels were carried out, whenever possible, by standard methods.[1] Due to the fact that certain of the panels were small in size (3-in. diameter), non-standard test specimens were used in testing these panels. Flexural specimens were tested flatwise with a 16:1 ratio of length to thickness; the length was 4 in. for the 8-in. square panels but somewhat shorter than 3 in. for specimens cut from the 3-in. disk panel. Two flexural specimens were tested from each 3-in. laminate. Tensile specimens cut from the 8-in. square panel were 7½ in. in length. Ash, water absorption, and specific gravity were determined on non-standard size specimens using standard procedures. The dielectric constant and power factor were determined at 60 and 1000 cycles with a Shering bridge and at 1 mc. with a twin-T bridge. The dielectric constant and dissipation factor for the epoxy laminates at 10,000 mc. were measured by a shorted line technique in an investigation conducted at the Naval Air Development Center at Johnsville, Pa.

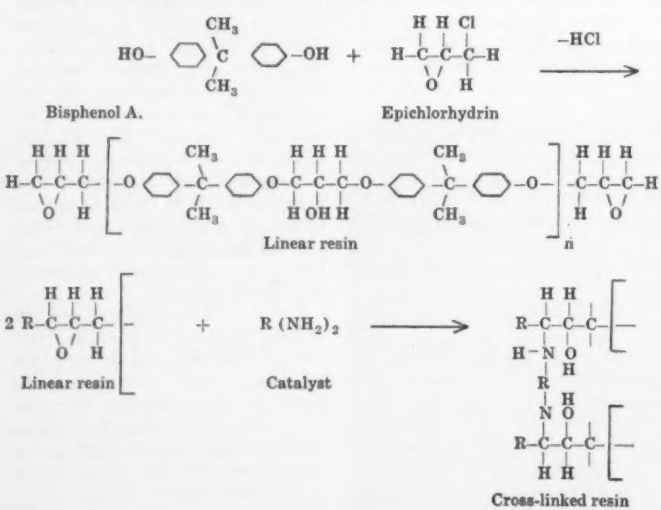
Physical evaluation of all specimens in Tables III and IV was carried out 4 months after their preparation. During this period the speci-

Table I.—Epon Resins Employed in Laminating Formulations[a]

Epon resins	*Viscosity*[b]	*Melting point ° C.*	*Color*[b, c]	*Specific gravity*	*Refractive index. n''_D*
RN-34	.....	20-28	10 max.	1.18	1.5815
1062	C-F	.....	5 max.	1.23	1.4772
1064	.....	40-45	8 max.	.....	1.5926
Reactive diluent, glycidyl allyl ether	A	—100	water-white	0.97	1.4374

[a] All data except refractive index furnished by Shell Chemical Corp.
[b] Gardner-Holdt.
[c] 40% solution in butyl Carbitol.

1—Generalized equations for condensation and polymerization reactions



[1] "A. S. T. M. Standards on Plastics," American Society for Testing Materials, Philadelphia, Pa. (Sept. 1948). "Federal Specification L-P-406a," Government Printing Office, Washington, D. C.

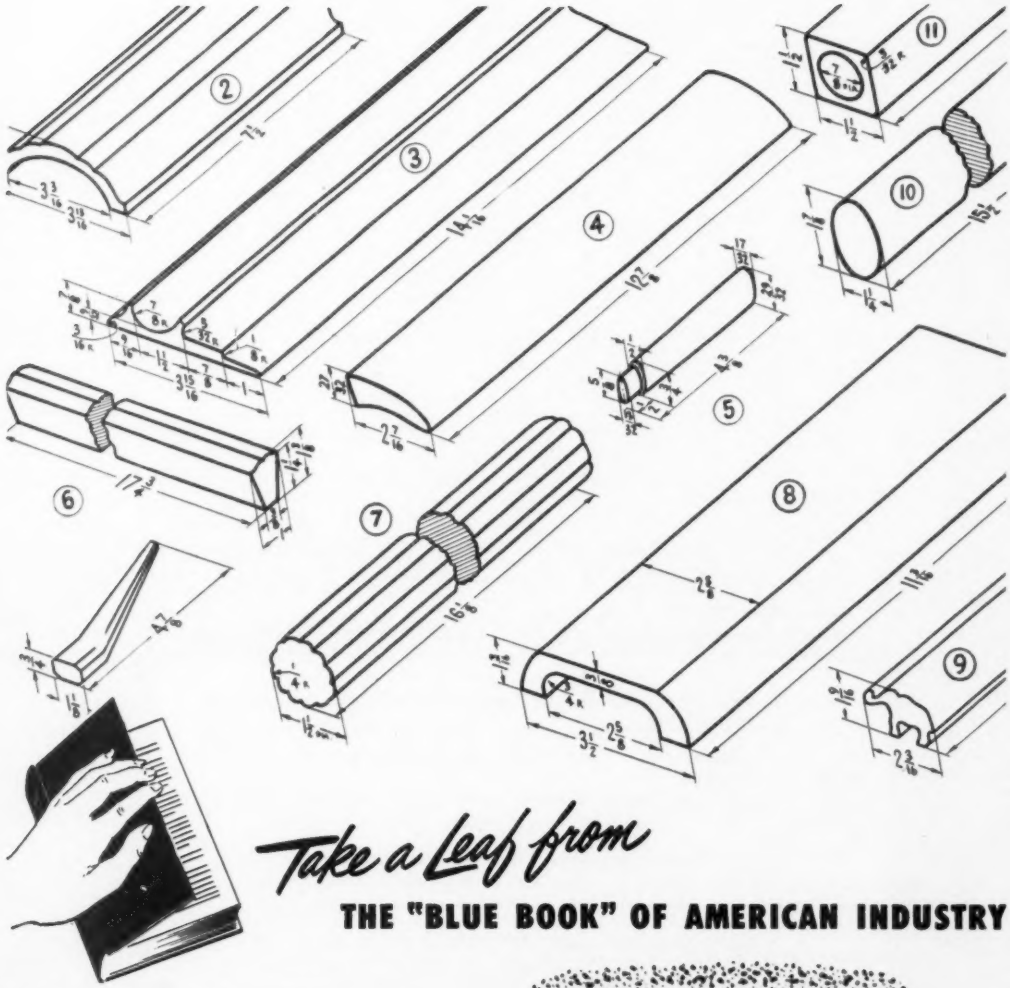


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Table II.—Effect of Catalyst Concentration on Cure of Epon Resins

Specimen	Resin, parts	Catalyst Type	Catalyst Concentration[a] parts	Properties after cure
		ROOM TEMPERATURE CURE (77° F., 24 HR.)		
A1	RN-34: 50 1062: 50	Diethylene-triamine	3	Liquid
A2	"	"	5	Gelled on top; liquid inside
A3	"	"	7	"
A4	"	"	9	Gelled
B1	"	Benzyldi-methylamine	11	Gelled; surface sticky
B2	"	"	13	Resin hard; surface tacky
B3	"	"	15	" "
B4	"	"	17	Resin hard; surface slightly tacky
B5	"	"	19	Resin hard; surface not tacky
C1	1064: 50 1062: 40 Dibutyl phthalate: 10	Diethylene-triamine	4	Resin gelled but soft and sticky
C2	"	"	8	Resin hard
		OVEN CURE (212° F., 30 MIN.)		
A3	RN-34: 50 1062: 50	Diethylene-triamine	7	Rubbery; cured to hard resin overnight
A4	"	"	9	Resin hard
B4	"	Benzyldi-methylamine	15	Resin hard and glossy
B5	"	"	17	" "
C1	1064: 50 1062: 40 Dibutyl phthalate: 10	Diethylene-triamine	4	Resin hard but flexible
C2	"	"	8	Resin hard and glossy

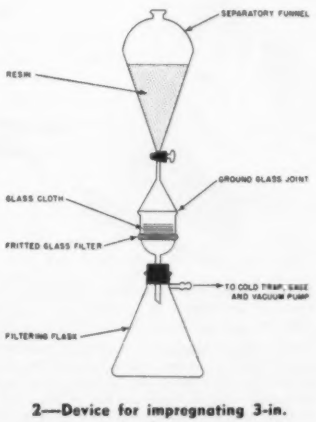
[a] Parts catalyst per 100 parts resin.

mens were maintained at 77° F. and 50% relative humidity.

Investigation of Cure Conditions

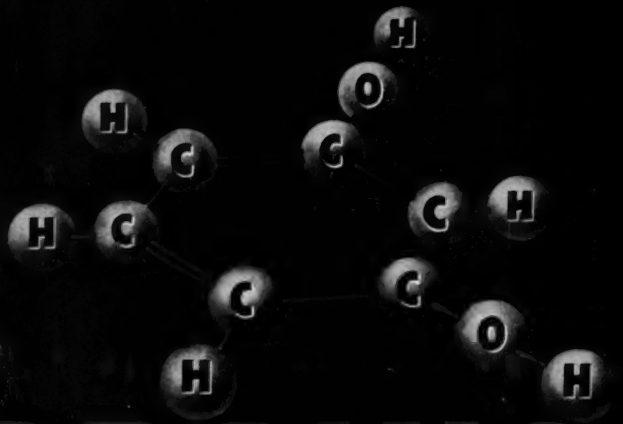
Experimental resin compositions were originally cast in 6-in. test tubes to study their cure characteristics. The exotherm was so great and the reaction so rapid that in many cases the resins boiled and solidified in a matter of a few minutes. To approximate the size and shape of the laminates employed in this investigation, castings of similar resin formulations were made in Petri dishes 3 in. in diameter. The results in Table II are quite different from those obtained with test tubes as indicated by the extended pot life of those specimens cured at room temperature. Results showed that cures could be effected with catalysts such as diethylenetriamine and benzyldimethylamine when heated at 212° F. for 30 minutes. Room temperature cures for the A and B formulations required the use of relatively large concentrations of catalysts, whereas the C formulation containing Epon 1064 and dibutyl phthalate cured at considerably lower concentrations of diethylenetriamine. These results indicated that Epon resins when cured at conditions approximating those of polyester resins could possibly be employed as laminating resins.

Laminates employing several of the formulations listed in Table II were prepared in 3-in. disks and were found to vary in flexural strength from 20,000 to 60,000 p.s.i. and in water absorption from 0.6 to 8% (data not reported in tables). The most promising of these formulations (A-4) from the viewpoint of high flexural strength and low water absorption was used as a basis for further investigation. The effect of variations in cure conditions is reported in Table III. Duplicate specimens in the form of 3-in. disks were prepared for each formulation so that flexural strength data could be obtained prior to and after water immersion. A flexural strength of 76,700 p.s.i., the highest in the series, was obtained with a cure of 200° F. for 30 minutes. Longer cures and cures at higher temperatures appeared to result in somewhat lower values in the order of 63,000 to 66,000 p.s.i. As the results are based on one specimen for each formulation, it is difficult to determine whether the differences in results are due to variations in cure conditions or are within the expected experimental spread of results. However, it is important to note the rather high order of flexural strength on the whole. Moisture



2—Device for impregnating 3-in. glass cloth laminate panels

absorption results appeared to increase with an increase in cure time and temperature. The decrease in flexural strength after water immersion was considerable, ranging from approximately 15 to 45%. This decrease was probably due to the large proportion of Epon 1062 in the formulation which, even after cure, has a considerable affinity for water. The A-4-1 speci-



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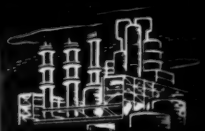

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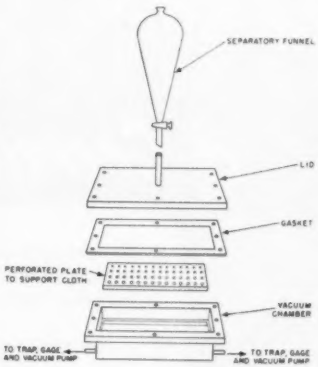
men was somewhat flexible after cure, but on standing for several days stiffened considerably. The other specimens were hard and tough after cure, and all specimens were quite translucent.

Effect of Glycidyl Allyl Ether

In order to reduce moisture absorption and increase flexural strength after water immersion, a reactive solvent, glycidyl allyl ether, was employed along with a reduction in the amounts of Epon 1062. The glycidyl allyl ether appeared to contribute to the reactivity of the resinous system. On the addition of the catalyst, diethylenetriamine, considerable heat was generated in thick sections of the resin causing it to boil and solidify in approximately 5 to 10 min. To avoid this it was necessary to transfer the resin to the glass cloth soon after the addition of a catalyst.

The results of tests on 3-in. disk laminates prepared from six formulations employing glycidyl allyl ether are presented in Table IV. Two sets of laminates for each formulation were made at pressures varying from 3 to 25 p.s.i. to study the effect of resin content on the properties of the laminate. Although pressures were maintained fairly closely, difficulty was experienced in obtaining the same resin content. This was probably due to differences in the fluidity depending on the resin composition and to some extent on the exotherm developed at the time of impregnation. Each set of panels consisted of two disks: one for the flexural test dry and one for flexural testing after immersion in water.

The highest flexural strengths were attained with those laminates prepared from the GAE-X-3 formulation. An ultimate flexural strength of 84,500 p.s.i. and a flexural modulus of 3.95 x 10^6 p.s.i. at a resin content of 26.3% were obtained before water immersion. The flexural strength of the GAE-X-4 laminate is exceptionally low (55,800 p.s.i.) and appears to be out of line with results obtained with the other formulations listed. No apparent reason for this discrepancy has been found, but other laminates prepared with the same formulation showed high flexural strengths (80,000 p.s.i.) even after water immersion up to 48 hours. The high flexural strengths for specimens subjected to water immersion for 24 and 48 hr. are a decided improvement over specimens made with the A-4 formulation (Table III) where large decreases were obtained under similar experimental conditions. The moisture absorption results are exceptionally low, ranging from 0.11 to 0.30% and are considerably better than those obtained without the use of glycidyl allyl ether (Table III). The specimens with the highest flexural properties and lowest water absorption are those with the lowest resin content.



3—Laminate panels 8 in. square were made in this steel chamber

It is evident from these results that in evaluating and comparing properties of laminates, it is important to consider the resin content. Important differences in strengths occur with changes in resin content. The apparent increase in flexural strength of several of the laminates after water immersion can probably be attributed to changes in the resin content rather than to any effect of the water.

All the laminates were flexible after cure and in a period of 2 to 3 days stiffened considerably. The low resin content laminates were opaque but were glossy and did not appear to be resin-starved. The higher resin content laminates exhibited

Table III.—Effect of Cure Conditions on A-4 Epoxy Resin[a] Laminates[b]

	Panel[c] A-4-a	*Panel[c] A-4-b*	*Panel[c] A-4-c*	*Panel[d] A-4-d*
Cure conditions				
Temp., °F.	200	200	250	300
Time, min.	30	60	30	30
Pressure, p.s.i.	3	3	3	3
Properties—dry				
Ultimate flexure, p.s.i.	76,700	65,800	65,400	63,500
Flexural modulus, 10^6 p.s.i.	3.3	3.1	3.0	3.0
Rockwell hardness	M113	M111	M112	M110
Specific gravity	1.67	1.66	1.68	1.69
Resin content, %	45.2	48.1	44.6	45.2
Moisture absorption				
24 hr., %	0.83	0.89	0.98	1.67
48 hr., %	1.00	1.12	1.29	2.14
Properties after 48 hr., water immersion at 77° F.				
Ultimate flexure, p.s.i.	48,800	53,900	54,600	42,700
Flexural modulus, 10^6 p.s.i.	2.3	2.3	2.6	2.1
Rockwell hardness	M112	M114	M114	M110

[a] A-4 Epoxy Resin Formulation:
Resin RN-34 50 parts
Resin 1062 50 parts
Diethylenetriamine 9 parts
[b] Ten layers of ECC—181-114 Fiberglas, 3 in. diameter.
[c] Panel slightly flexible after cure; stiffened on standing 2 wk. at 77° F. before being tested; quite translucent.
[d] Panel hard and inflexible after cure; quite translucent.

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Table IV.—Properties of Laminates Based on Epoxy Resin with Glycidyl Allyl Ether as Reactive Solvent[a]

	GAE-X-2	GAE-X-3	GAE-X-4	GAE-X-2a	GAE-X-3a	GAE-X-4a
Formula						
RN-34, parts	85	75	80	85	75	85
1062, parts	....	25	....	....	25	....
Glycidyl allyl ether, parts	15	10	20	15	10	20
Diethylenetriamine, parts	8	8	8	8	8	8
Properties of resin						
Viscosity, poises[b]	7.6	17.6	4.0	7.6	17.6	4.0
Refractive index[b]	1.5488	1.5402	1.5438	1.5488	1.5402	1.5438
Cure conditions						
Temp. °F.	200	200	200	200	200	200
Time, min.	30	30	30	30	30	30
Pressure, p.s.i.	25	25	10	3	3	3
Resin content—%						
Panel I[c], %	29.9	26.5	29.6	48.8	44.3	37.4
Panel II[d], %	29.9	29.8	34.2	46.0	35.6	36.2
Properties, dry						
Ultimate flexure, p.s.i.	73,450	84,500	55,800	61,400	66,600	65,300
Flexural modulus, 10^6 p.s.i.	3.55	3.98	3.09	3.02	3.13	3.28
Rockwell hardness	M108	M108	M106	M112	M113	M108
Specific gravity	1.94	2.01	1.91	1.64	1.69	1.72
Moisture absorption						
24 hr., %	0.11	0.20	0.27	0.24	0.28	0.24
48 hr., %	0.12	0.27	0.31	0.26	0.35	0.30
Properties after 24 hr. water immersion at 77° F.						
Ultimate flexure, p.s.i.	75,800	77,500	80,900	63,300	78,600	66,800
Flexural modulus, 10^6 p.s.i.	3.90	3.69	3.77	2.90	3.47	3.28
Rockwell hardness	M112	M113	M110	M105	M104	M110
Properties after 48 hr. water immersion at 77° F.						
Ultimate flexure, p.s.i.	76,600	70,200	79,800	59,400	67,500	66,500
Flexural modulus, 10^6 p.s.i.	3.90	3.94	3.60	2.85	3.63	3.32
Rockwell hardness	M112	M113	M110	M113	M113	M111

[a] Ten layers ECC-181-114 Fiberglas, 3 in. diameter.
[b] At 77° F. without catalyst.
[c] Specimens cut from panel I were tested without water immersion.
[d] Specimens cut from panel II were tested after water immersion.

greater translucence and were also quite glossy.

Effect of Fabric Treatments

Epoxy laminates prepared with heat-treated glass cloth displayed high flexural properties, approximating the same order of strength usually obtained with ECC-181-114 glass cloth as results in Table V indicate. The good adhesion of the resin to glass cloth may possibly eliminate the application of an additional chemical pretreatment of the cloth such as treatment No. 114 which is presently employed to improve the bond. However, this point should be substantiated by additional studies to determine the effect of using heat-treated glass cloth on other pertinent properties of the laminate in addition to flexural strength.

Larger panels, approximately 8 by 8 in., based on the GAE-X-3 formulation were prepared with a range of resin contents. The high flexural strength of 84,500 p.s.i., attained with the GAE-X-3 laminate in Table IV, was not repeated in this series because none of the epoxy laminates had a resin content as low as 26.3%. Apparently, increasing the resin content results in a decrease in flexural strength. Their physical and dielectric properties are compared with those of polyester laminates prepared from Selectron 5003 and ECC-181-114 following the same procedure as for the epoxy resin laminates. Results in Table VI indicate that epoxy resin laminates of similar resin content to that of the polyester laminates are better in regard to flexural, tensile, and edgewise compression but somewhat weaker in edgewise impact. The moisture absorptions after 48 hr. appear to be in about the same order of magnitude for both types of laminates. The dielectric properties of the polyester laminates are superior, having lower dielectric constants and power factors.

Summary and Conclusions

Epoxy resins have been compounded into laminating liquids with good penetrating and wetting properties on glass cloth. Data obtained appear to substantiate the hypothesis that resins with good adhesion to glass and small shrinkage on cure result in glass cloth laminates of improved mechanical strength. Glass cloth laminates prepared with these resins have exceptionally high physical properties with a flexural strength of 85,-

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Table V.—Properties of GAE-X-3 Epoxy Resin[a] Laminates Prepared with Heat-Treated and 114-Treated Glass Cloth[b]

	Heat-treated cloth	*114-treated cloth*
Cure conditions		
Temperature, °F.	250	250
Time, min.	60	60
Pressure, p.s.i.	25	25
Resin content		
Panel I[c], %	27.8	25.1
Panel II[d], %	27.6	32.6
Properties, dry		
Ultimate flexure, p.s.i.	70,400	73,500
Flexural modulus, 10^6 p.s.i.	4.00	3.71
Rockwell hardness	M110	M109
Specific gravity	1.95	1.86
Moisture absorption, 48 hr., %	0.65	0.62
Properties after 48 hr. water immersion at 77° F.		
Ultimate flexure, p.s.i.	66,250	76,000
Flexural modulus, 10^6 p.s.i.	3.75	3.91
Rockwell hardness	M113	M113

[a] GAE-X-3 Epoxy Resin Formulation:
Resin RN-34 75 parts
Resin 1062 25 parts
Glycidyl allyl ether 10 parts
Diethylenetriamine 8 parts
[b] Ten layers of 181 Fiberglas, 3 in. diameter.
[c] Specimens cut from panel I were tested without immersion in water.
[d] Specimens cut from panel II were tested after immersion in water.

000 p.s.i. and a flexural modulus of 4 x 10^6 p.s.i. Their tensile and edgewise compressive properties exceed those of polyester laminates, although their edgewise Izod impact strengths are somewhat lower. Their moisture absorption after 48 hr. water immersion are in the same order of magnitude as polyester laminates. Their dielectric constants and dissipation factors are slightly higher than those of polyester laminates. When compared to structural steel and 24ST aluminum on an equal weight basis, their flexural, tensile, and compressive properties are greatly superior. Nothing is known of their aging characteristics nor their strength at low and high temperatures. A defect in the present formulation is the uncontrolled exotherm of the catalyzed liquid resin when contained in thick sections prior to impregnation of the glass cloth. However, on the basis of the data presented, epoxy resins present new and interesting possibilities in the development of laminates for applications where light weight and high strength are required characteristics.

Table VI.—Properties (Dry) of GAE-X-3 Epoxy and Polyester Resin Laminates[a]

Property	*GAE-X-3*[b]	*GAE-X-3*[b]	*GAE-X-3*[b]	*Selectron*[c] *5003*	*Selectron*[c] *5003*	*Selectron*[c] *5003*
Resin content, %	45.4	41.3	34.6	46.5	42.8	30.7
Ultimate flexure, p.s.i.	65,750	74,350	79,800	53,180	58,575	59,490
Flexural modulus, 10^6 p.s.i.	2.89	3.18	3.50	2.76	2.81	2.98
Ultimate tension, p.s.i.	44,650	49,000	44,200	40,810	42,850	.....
Tensile modulus, 10^6 p.s.i.	2.77	2.91	2.68	2.76	2.83	....
Edgewise compression, p.s.i.	51,150	52,200	43,300	37,350	34,100	.....
Edgewise Izod impact, ft. lb./in.	10.0	10.9	12.3	13.7	14.6	.....
Dielectric constant, 60 cy.	5.48	5.46	5.87	4.43	4.43	4.56
Dielectric constant, 10^3 cy.	5.36	5.34	5.72	4.41	4.38	4.33
Dielectric constant, 10^6 cy.	4.91	4.91	5.32	4.28	4.35	4.07
Dielectric constant, 10^{10} cy.	.....	.....	4.50	.....	3.60	.....
Dissipation factor, 60 cy.	0.011	0.014	0.015	.....	.....	....
Dissipation factor, 10^3 cy.	0.014	0.016	0.016	0.013	0.012	0.028
Dissipation factor, 10^6 cy.	0.025	0.023	0.023	0.011	0.012	0.012
Dissipation factor, 10^{10} cy.	.....	.....	0.020	.....	0.007	.....
Rockwell hardness	M113	M113	M114	M112	M109	M112
Specific gravity	1.69	1.72	1.85	1.72	1.75	1.90
Moisture absorption						
24 hr., %	0.53	0.46	0.54	0.23	0.20	0.26
48 hr., %	0.64	0.57	0.63	0.29	0.64	0.38

[a] Ten layers ECC—181-114 Fiberglas, 8 by 8 in.
[b] Cure: 60 min. at 250° F.
[c] Cure: 10 min. at 100° F. and 30 min. at 250° F.

Radiographic Testing of Filled Plastics

by FRED B. SHAW, Jr.*

WHEN items are molded from compositions which contain coarse pigments, fillers, or fibers, it has frequently been observed that uniform dispersion of the correct amount of these components may readily be obtained during the developmental stage, with resulting optimum physical properties, but that when the item is placed in production, dispersion and relative composition are subject to variation greater than can be tolerated. This excessive variation has to be eliminated if the item is to be a success. However, the study of the process which must be made in order to eliminate excessive production variables presupposes a method for accurately assessing individual pieces. Further, even under normal production conditions, occasional unsatisfactory pieces will be manufactured and must be capable of being detected and eliminated by a reliable system.

Occasionally designers and fabricators of plastic items which incorporate coarse pigments, fillers, or fibers have attempted to make determinations of such pigment, filler, or fiber content by extracting a weighed portion of the structure with a liquid which is a solvent for the resin but a non-solvent for the fiber. This approach affords useful results only when a number of small samples are taken from one fabricated piece, and its disadvantages are manifold. It is destructive, time-consuming, and yields values which are average for the sample but not specific for any given point.

It is proposed that radiography affords an accurate and rapid means for the solution of this problem in those common cases where the pigment, filler, or fiber is inorganic in nature. It is believed that this approach is particularly advantageous in the case of glass-fiber reinforced polyesters which are now in such common use and which are difficult to analyze by the destructive method because of the relative insolubility of the resin.

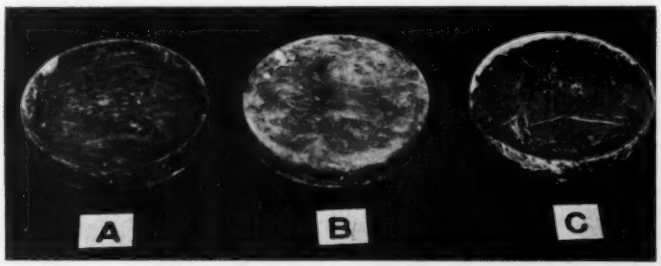
As an example of the application of radiographic techniques to the problem of non-destructive determination of inorganic pigment, filler, and reinforcing fiber content of plastic materials, reference is made to Fig. 1. The three 3-in. diameter by ½-in. thick disks illustrated

(*Continued on p. 178*)

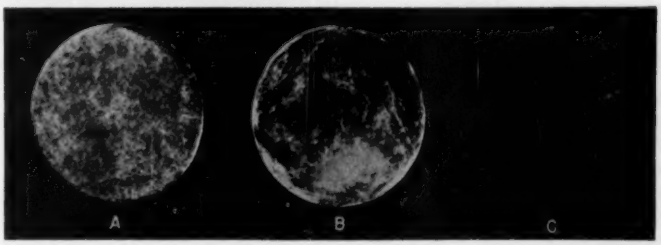
Table I.—Densitometer Measurements on Radiographs of Molded Disks[a]

DISK A		*DISK B*		*DISK C*	
Density	Deviation from mean	Density	Deviation from mean	Density	Deviation from mean
0.89	−0.09	1.31	+0.23	1.34	+0.04
1.00	+0.02	1.18	+0.10	1.18	−0.12
1.02	+0.04	1.04	−0.04	1.23	−0.07
0.99	+0.01	0.66	−0.42	1.39	+0.09
1.10	+0.12	1.44	+0.36	1.24	−0.06
1.03	+0.05	0.98	−0.10	1.22	−0.08
0.95	−0.03	0.88	−0.20	1.30	0.00
1.04	+0.06	1.04	−0.04	1.35	+0.05
0.88	−0.10	1.20	+0.12	1.28	−0.02
0.90	−0.08	1.08	0.00	1.43	+0.13
$\sigma = 0.07$		$\sigma = 0.21$		$\sigma = 0.08$	
$R = 0.22$		$R = 0.78$		$R = 0.25$	
$\overline{X} = 0.98$		$\overline{X} = 1.08$		$\overline{X} = 1.30$	

[a]Code for abbreviations: $\overline{X}$ = arithmetic mean (average); σ = standard deviation; R = range (difference between maximum and minimum).



1—Visual check of specimen disks (A and B contain 25% glass fiber and C has 20%) indicate no apparent differences between A and C; B shows only minor non-uniformity



2—Under radiographic test, such individual characteristics as B's non-homogeneity and the higher fiber content of A as compared to C are clearly demonstrated

*Chief, Engineering Div., Technical Command, Army Chemical Center.

PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

THE GROWTH OF THE PLASTICS INDUSTRY. Brit. Plastics *23*, 2-15 (July 1950). The history of the plastics industry in Great Britain from 1865 to 1950 is reported. Developments in materials and products are described and illustrated.

PLASTICS: ORGANIC. F. W. Reinhart and G. M. Kline. Medical Physics (Year Book Publishers, Inc., Chicago) Vol. II, 728-36 (1950). The properties and applications of plastics are reviewed with particular emphasis on those of interest in medical devices.

POLYMER EMULSION ECONOMIES SPUR WIDENING USE. G. L. Brown. Chem. Ind. *67*, 38-40 (July 1950). The advantages and limitations of using polymer water emulsions in the coating and impregnating field are discussed. The techniques involved are described. Most thermoplastics and rubbers may be used in the form of emulsions.

Applications

NYLON IN BEARINGS AND GEARS. W. C. Wall. Product Eng. *21*, 102-7 (July 1950). The properties of nylon plastic with particular reference to those of interest in bearing and gear application are described. They are finding wide use in bearings and gears because of high shock resistance, good bearing strength and ability to operate successfully without lubrication.

USE OF SYNTHETIC SHOE SOLES IN THE UNITED STATES. J. J. Lamb and J. R. Kanagy. The Times Review of Industry *4*, 74, 76 (Aug. 1950). The properties of vinyl plastics, synthetic rubber and leather for use in shoe soles are compared. Production statistics are given which show that the percent of civilian shoes in U. S. A. in 1949 with leather soles was 56.5 compared to 73.4 in 1939 and 94.3 in 1926. Problems encountered in using synthetics for shoe soles are reviewed.

PRESSURE-SENSITIVE ADHESIVE TAPES FOR IMPROVED INSULATION, FASTER ASSEMBLY. P. L. Hedrick and W. H. O'Neal. Electrical Manuf. *46*, 83-7, 172, 174, 176 (July 1950). The properties of several types of pressure-sensitive adhesive tapes used for electrical insulation are compared. Paper, fabric, plastic film, and combinations are considered.

Molding and Fabricating

LOW COST FINISHING OF PLASTIC PARTS. Elec. Mfg. *46* 120-2, (Aug. 1950). Molded plastic parts are finished 1) by blasting with crushed walnut shells and crushed apricot pits and 2) by rotating at high speed in a drum wherein crushed nut shells and fruit pits are thrown against the surface of the part. The fins and flash are removed economically without injury to surface or properties of the parts.

Testing

QUALITATIVE ANALYSIS OF SYNTHETIC RESINS USED IN LEATHER FINISHES. V. Pektor. Paint Technol. *15*, No. 171, 105-7 (1950). Methods for determining resin, chloride, acetate and plasticizer content, fluorescence, and changes on fusing are used to identify water dispersions of vinyl and acrylic plastics used in leather finishes.

MICROBIOLOGICAL DETERIORATION OF ORGANIC MATERIALS: ITS PREVENTION AND METHOD OF TEST. E. Abrams. National Bureau of Standards Miscellaneous Publication 188, 41 pp. (Nov. 1948). A detailed review of the literature on the microbiological deterioration of organic and fibrous materials is presented. Representative problems incidental to the development of test methods for the evaluation of mildew resistance and the development of mildew resistant materials are given. The most widely recognized test methods for the evaluation of mildew-resistance and rot-resistance are listed. A wide variety of fungicides for different uses is classified according to effectiveness. Plastics and plasticizers and related materials are rated according to their susceptibility to support mold growth. 179 references.

DETERMINATION OF UNSATURATION OF BUTYL RUBBERS AND CERTAIN BRANCHED OLEFINS. T. S. Lee, I. M. Kolthoff and E. Johnson. Analytical Chem. *22*, 995-1001 (Aug. 1950). The reaction of iodine monochloride with highly branched olefins and polymers is abnormal in that the addition products formed possess steric strain and tend to decompose. The products of decomposition react further with iodine monochloride, generally leading to high results in the determination of unsaturation. Based upon the fact that the addition of iodine monochloride to the decomposition product is not so rapid as the addition of iodine monochloride to the original olefin or polymer, new procedures were developed for the determination of unsaturation of highly branched ethylenic substances. The procedures are shown to give reliable results for olefins such as the diisobutylenes and for copolymers, such as isoprene butyl rubber and butadiene butyl rubber.

DETERMINATION OF FREE CARBON IN CURED RUBBER STOCKS. I. M. Kolthoff and R. G. Gutmacher. Analytical Chem. *22*, 1002-3 (Aug. 1950). A method for the determination of free carbon in vulcanized rubber stocks is described. The method was successfully applied to natural rubber, GR-S, butyl rubber, and neoprene. No correction is necessary.

THICKNESS GAGE FOR CONTINUOUS SHEET. Brit. Plastics *22*, 319-20 (June 1950). A thickness gage based on radioactive isotopes is used to measure the thickness of polyvinyl chloride plastic sheeting as it comes from the calender.

A RAPID METHOD TO DETERMINE THE COMPLETENESS OF THE POLYMERIZATION OF METHACRYLIC RESINS. W. Bauer. Kunststoffe *40*, 94 (1950); Chem. Abstracts *44*, 5635 (June 25,

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1950). An incompletely polymerized methacrylic resin develops bubbles on the surface when immersed in glycerol at 120-175° C. for 30 sec.: completely polymerized material does not develop bubbles.

Materials

TETRAMETHYLOLCYCLOHEXANOL ROSIN ESTER IN NITROCELLULOSE LACQUERS. H. Wittcoff, M. H. Baker and L. Champlin, Jr. Ind. Eng. Chem. *42*, 1920-5 (Sept. 1950). The rosin ester of 2,2,6,6,-tetramethylolcyclohexanol, a cyclic pentahydric alcohol derived from cyclohexanone and formaldehyde, is of interest as an additive for cellulose nitrate lacquers. Its performance is compared in a series of evaluations to four commercially available maleic modified rosin esters. The lacquers tested were formulated with constant amounts of resin but with quantities of plasticizers varied to provide approximately the same hardness after 1 hr. at 55° C. The tests included determination of viscosity of the lacquers and the hardness, flexibility, and abrasion resistance of the films. The films were compared also in regard to drying times, water, alkali, acid, and solvent resistance, solvent compatibility, and rate of solvent escape. It is concluded that the rosin ester of 2,2,6,6-tetramethylolcyclohexanol compares very favorably with the commercial maleic modified resins and is of potential value in lacquer formulations.

NEW FLUORINE PLASTICS. L. C. Rubin. Product Eng. *21*, 130-4 (May 1950). Information on the chemical resistance, mechanical properties, electrical properties, heat resistance, heat treating, plasticizing, molding and fabricating, machining and applications of monochlorotrifluoroethylene plastic is presented. This plastic has excellent properties, high heat resistance, good dimensional stability in the presence of water, good chemical resistance, is thermoplastic, and can be injection molded. The surface hardness can be varied by heat treatment.

THE PREPARATION OF 1,4-DIVINYL-2,3,5,6-TETRACHLOROBENZENE AND ITS COPOLYMERIZATION WITH STYRENE. S. D. Ross, M. Markarian, H. H. Young, Jr. and M. Nazzewski. J. A. C. S. *72*, 1133-7 (Mar. 1950). A synthesis of 1,4-divinyl-2,3,5,6-

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tetrachlorobenzene is described and its copolymerization with styrene was studied. The reactivity of the divinyl compound is such that high degrees of conversion are obtained at the gelation point.

CADMIUM PIGMENTS FOR P. V. C. R. B. Wright. Plastics (London) *15*, 167-9 (June 1950). Cadmium pigments disperse readily, are stable and have no deleterious effect on polyvinyl chloride plastics. The colors produced range from greenish-yellow, through reddish-orange, orange, red, to maroon. The incorporation of lead salts in the formulation may cause darkening unless special care is taken in processing.

PLIOFILM. N. D. Coulter and P. J. Vaughan. Modern Packaging *23*, 153-8 (July 1950). The properties of films of rubber hydrochloride are reviewed and recent formulations and applications are described. Water vapor and gas permeabilities are reported. Several packaging applications, particularly of food stuffs, are illustrated.

STUDIES WITH LIQUID PHENOL-FORMALDEHYDE RESINS. K. H. Hauck. Kunststoffe *39*, 237-48 (1949). Chem. Abstracts *44*, 1743 (Feb. 25, 1950). The effects of several variables in the synthesis of liquid phenol-formaldehyde resins were studied. Reaction times, gel formation and viscosity were studied as a function of alkali concentration, phenol-formaldehyde rate, cresol content, temperature, and time. Increasing alkali content causes a decrease in electrical resistance. 27 references.

ARALDITE RESINS FOR THE JOINING OF METALS. M. H. Fournier. J. Soc. Ing. Automobile *22*, 344-5 (1949); Chem. Abstracts *44*, 1743 (Feb. 25, 1950). Synthetic resins made from ethylene oxide cure without the formation of any by-products and without shrinkage. They are cured at 140° to 190° C. for 15 hr. to 20 minutes. They have excellent adhesion to many metals.

Chemistry

QUANTUM YIELDS OF DECOMPOSITION PRODUCTS FROM THE COPOLYMER OF VINYLIDENE AND VINYL CHLORIDE. J. E. Wilson. J. A. C. S. *72*, 2905-8 (July 1950). Quantum yield of hydrogen chloride evolution from the solid copolymer of vinylidene and

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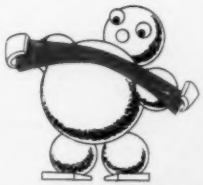

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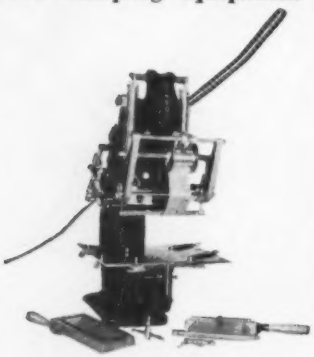

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vinyl chloride is essentially constant at 0.7×10^{-2} over a ten-fold range of intensity using 2537 A. light. Yield of hydrogen chloride is so small that production of colored systems of conjugated double bonds by hydrogen chloride loss alone is questionable. Evolution of another product gas, probably water, was observed.

A Study of the Interaction of Nitrocellulose With Some Solvents and Non-Solvents by the Light-Scattering Method. R. H. Blaker and R. M. Badger. J. A. C. S. *72*, 3129-32 (July 1950). The thermodynamic interaction between cellulose nitrate and several substances, both solvents and non-solvents, was investigated by light scattering observations on acetone solutions of polymer to which the substance in question was added. The additives, *n*-butyl acetate, diethyl phthalate, water, ligroin, and *s*-butyl chloride, were all found to be selectively adsorbed on cellulose nitrate. An expression is given for the activity of cellulose nitrate as a function of its concentration and of the solvent additive.

Diazothiolic Esters (Diazo Thio Ethers): Initiators and Modifiers of Polymerization Reactions. W. B. Reynolds and E. W. Cotten. Ind. Eng. Chem. *42*, 1905-10 (Sept. 1950). Diazothiolic esters (diazo thio ethers) are useful initiators for polymerization reactions. In addition to functioning as chain initiators, these materials exert a powerful "modifying" or "regulating" action leading to the production of soft benzene-soluble polymers. They are of particular utility in the emulsion polymerization and copolymerization of diene monomers such as butadiene.

Polymerization. C. C. Winding. Ind. Eng. Chem. *42*, 1724-31 (Sept. 1950). Developments in polymerization techniques and equipment during the last year are reviewed. 264 references.

Coatings

Silicone Surface Coatings. M. A. Glaser. Product Eng. *21*, 109-11 (Feb. 1950). Modified silicone plastic finishes have superior stability on exposure to electrical forces, to heat, to water and outdoors. Data on pigmentation, hardness, abrasion resistance, chemical resistance, impact resistance and accelerated weathering are presented.

Properties

Stress Cracking of Polyethylene. R. H. Carey. A.S.T.M. Bull. *1950*, No. 167, 56-60 (July 1950). The effects of some environments upon the tensile properties of polyethylene are reported. It is found that tension specimens containing a small hole break at stresses and elongation less than those normally reported. This change in mechanical properties is greatly accentuated by fluids such as alcohols and toluene. This phenomenon is compared to "stress corrosion cracking" as observed in metals where cracking occurs in mildly corrosive environments. Data are reported for polyethylenes with a wide range of molecular weights, and the effects of environment are found to decrease with increasing molecular weight of the resin. The data permit quantitative comparison of the cracking resistance of different resins.

Cold Compression Set of Elastomer Vulcanizates. R. E. Morris, J. W. Hollister, and A. E. Barrett. Ind. Eng. Chem. *42*, 1581-7 (Aug. 1950). The significance of the cold compression set of elastomer vulcanizates as regards internal viscosity, second order transition, and tendency to crystallize is discussed. It is shown experimentally that the ability of a gasket to maintain a seal when compressed for extended periods at low temperatures can be foretold from compression set tests.

Porosity of Paint Films. I. Wolock and B. L. Harris. Ind. Eng. Chem. *42*, 1347-9 (July 1950). Surface area measurement of adsorption of krypton is extended to samples of total surface area equal to 1000 sq. cm. and applied to the study of unsupported linseed oil films. The observance of very low roughness factors leads to the conclusion that there is no appreciable quantity of discrete fine pores—i.e., the order of several molecular diameters—in such films. Extraction of the films with acetone resulted in approximately the same weight loss for films of different thicknesses and very little increase in surface area.

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U. S. PLASTICS PATENTS

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EXTRUSION. D. J. Weber (to Yardley Plastics). U. S. 2,512,844, June 27. Apparatus for extruding hollow plastic tubes.

CELLULOSE DERIVATIVES. P. W. Morgan (to Du Pont). U. S. 2,512,960, June 27. Hydroxyethyl cellulose acetate and chloroacetate.

CELLULOSE ESTERS. R. G. Tritsmans and S. P. Hendriex (to Gevaert). U. S. 2,512,983, June 27. Cellulose mixed esters.

EPOXIDE RESINS. C. E. Bixler (to Devoe and Raynolds). U. S. 2,512,996-7, June 27. Heat-convertible composition comprising an aliphatic polyepoxide and a resinous ether epoxide and integral brush assemblies prepared therewith.

PLASTIC ARTICLES. R. E. Roberts. U. S. 2,513,052, June 27. Method and apparatus for making hollow plastic articles.

POLYMERS. W. E. Kemp (to Dominion Tar and Chemical). U. S. 2,513,180, June 27. Reacting methyl benzene with acetylene in the presence of hydrogen fluoride to produce resins.

COPOLYMERS. S. S. Kurtz, Jr. (to Sun Oil). U. S. 2,513,183, June 27. Butadiene-styrene copolymer containing a polymer of isobutylene, butadiene, and styrene copolymerized with a Friedel-Crafts catalyst.

RESINS. A. D. Macallum. U. S. 2,513,188, June 27. Mixed phenylene sulfide resins.

COMPOSITE. R. Steinman (to Owens-Corning). U. S. 2,513,268, June 27. Diallyl phthalate resin having glass fibers distributed therethrough together with a small amount of methallyl silicate.

RESIN. R. A. Barkhuff, Jr. (to Monsanto). U. S. 2,513,274, July 4. A rapid-curing combination comprising a mixture of a liquid phenol-formaldehyde resin acidified to pH 4.5-7 and a phenol-resorcinol-formaldehyde resin.

COPOLYMER. W. E. Hanford (to Du Pont). U. S. 2,513,312, July 4. Copolymerizate of a mixture of chlorotrifluoroethylene and vinyl fluoride.

POLYMER. D. W. Young and J. D. Calfee (to Standard Oil). U. S. 2,513,389, July 4. A solid oxidized polymer of alkyl pentadiene prepared with a Friedel-Crafts catalyst.

SHEET. J. S. Tinsley (to Hercules). U. S. 2,513,434, July 4. Apparatus for forming particles of thermoplastic material into a sheet on a continuous conveyer belt.

SEALING COMPOSITION. R. A. Barkhuff, Jr. (to Monsanto). U. S. 2,513,614, July 4. A phenol-resorcinol-formaldehyde resin and a formaldehyde liberating agent composition for oil well logging.

CELLULOSE ETHERS. A. A. Houghton (to I. C. I.). U. S. 2,513,725, July 4. Method for the preparation of hot and cold water-soluble cellulose ethers.

VINYL ETHERS. C. E. Schildknecht (to General Aniline). U. S. 2,513,820, July 4. Polymerizing a vinyl ether in solvent.

TOOTH. E. B. Kelly (to Myerson Tooth). U. S. 2,514,075, July 4. A composite plastic tooth and method of preparing same.

HEAT-TREATMENT. J. Pinsky (to Plax). U. S. 2,514,088, July 4. Heating articles of polystyrene and methylmethacrylate in a bath and cooling in air.

SHEET MATERIAL. F. J. Kaszuba (to General Aniline). U. S. 2,514,131, July 4. Producing sheets of water-soluble film-forming material.

POLYMERS. R. R. Whetstone, S. A. Ballard, and C. J. Ott (to Shell). U. S. 2,514,172, July 4. Esters of dihydro-and tetrahydropyran carboxylic acids and polymers thereof.

THERMOPLASTIC SPLICING. J. H. Lower (to Firestone). U. S. 2,514,184, July 4. Method of splicing thermoplastic monofilaments with high-frequency energy.

VINYL RESIN. K. C. Eberly (to Firestone). U. S. 2,514,185, July 4. Composition of polyvinyl chloride compounded with tetraethylene pentamine.

FILAMENT SPLICING. F. J. Groten and W. J. Nanfeldt (to Firestone). U. S. 2,514,197, July 4. Splicing thermoplastic filaments with high-frequency energy.

EXTRUSION. O. W. Carlson (to Firestone). U. S. 2,514,211, July 4. Adjustable extrusion machine.

EMBOSSING. J. K. Mason and P. P. Crisp (to Firestone). U. S. 2,514,213, July 4. Apparatus for continuously embossing leather-like plastic.

RESIN. H. A. Walter (to Monsanto). U. S. 2,514,268, July 4. Thermosetting resin comprising a condensate of an aldehyde and a silicon oxyamide.

ACRYLIC RESINS. C. E. Barnes (to General Aniline). U. S. 2,514,305, July 4. Alpha-halogen substituted acrylic acid and an ester of a monohydroxy monocarboxylic acid copolymerized.

RESINS. G. D. Jones (to General Aniline). U. S. 2,514,328, July 4. Composition of gelatin and a water-soluble reaction product of polyvinyl-isocyanate and an alcohol.

RESIN. H. A. Walter (to Monsanto). U. S. 2,514,353, July 4. A thermosetting resin comprising the condensate of 2-oxo-4,5-diimino-parabanic acid and an aldehyde.

COPOLYMERS. D. E. Adelson and H. Dannenberg (to Shell). U. S. 2,514,354, July 11. A copolymer of diallyl carbonate and an ester of diallyl adipate or a diallyl ester of a mononuclear aromatic dicarboxylic acid.

POLYESTERS. S. E. Glick (to Monsanto). U. S. 2,514,389, July 11. Polymerizable styrene-tall oil-modified polyester composition.

MOLDING. R. H. Hagen (to Plymouth Industrial Products). U. S.

(*Continued on p. 135*)

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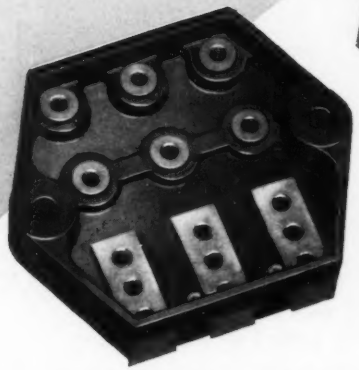

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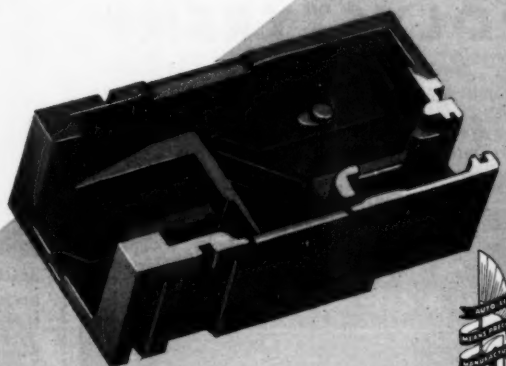

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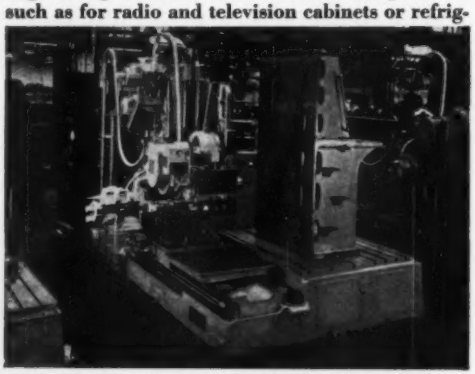

For estimates on all types of molds, consult the

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2,514,390, July 11. Injection molding device.

MOLDING. L. B. Green. U. S. 2,514,486, July 11. A molding machine.

RESINS. P. D. Morton (to Sharples Chemicals). U. S. 2,514,505, July 11. Resinous condensate of urea, alkylurea, formaldehyde, and a polyhydric alcohol.

TEETH. V. V. Ushanoff. U. S. 2,514,592, July 11. Anterior bridge plastic teeth.

HOLLOW ARTICLES. Le G. Daly. U. S. 2,514,597, July 11. Method of making hollow articles from plastic-impregnated fabric.

COPOLYMERS. J. R. Caldwell (to Eastman). U. S. 2,514,624, July 11. Copolymers of acrylonitrile and isopropenyl acetate.

ANTI-FOULING COATING. D. S. Hubbell (to H. H. Robertson). U. S. 2,514,868, July 11. Anti-fouling coating of pigment, rosin, Hercolyn, chlorinated rubber, silica, naphtha.

MOLDING. C. E. Maynard (to Prophy-lac-tic Brush). U. S. 2,514,884, July 11. Machine for injection molding plastic material.

COPOLYMER. H. T. Neher, E. H. Kroeker, and W. J. Croxall (to Rohm and Haas). U. S. 2,514,895, July 11. Alkyl allyloxyalkyl maleate copolymers.

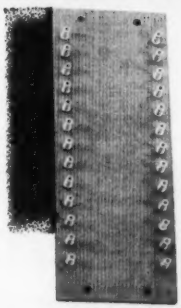
POLYMER COMPOSITION. W. R. Turner and R. G. Heiligmann (to Atlantic Refining). U. S. 2,514,979, July 11. Composition of propylene-butadiene copolymer and a hydrocarbon wax.

SNOWSHOE. D. F. Anderson (to Fiberlast of Canada). U. S. 2,515,070, July 11. A snowshoe comprising a rigid outer frame, a covering of resin-bonded fibrous glass molded thereon, and reinforcing members.

HOLLOW ARTICLES. E. E. Mills, U. S. 2,515,093, July 11. Apparatus for molding hollow plastic articles.

FURFURAL RESINS. J. R. Dudley (to American Cyanamid). U. S. 2,515,116, July 11. A water-insoluble anion-active resin obtained by reacting furfural, a quanidine condensate, with an aldehyde.

INTERPOLYMERS. C. R. Milone (to Wingfoot). U. S. 2,515,132, July 11. Interpolymers of diallyl esters of



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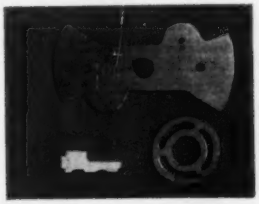

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diethyl ether-dicarboxylic acids.

VINYL ETHERS. D. E. Sargent (to General Aniline). U. S. 2,515,164, July 11. Condensates of vinyl ethers with an aryl hydroxyl, amino, or mercapto compound.

PAD DYEING. N. S. Cassel and A. T. Clifford (to Interchemical). U. S. 2,515,170, July 18. Dyeing composition comprising a dispersion of pigment in aqueous solution of thermosetting resin, water-soluble alkyl cellulose, a mannogalactan flour.

EXTRUSION. F. E. Dulmage and G. W. Cheney (to Dow Chemical). U. S. 2,515,201, July 18. Gear pump for metering and extruding hot organic thermoplastics.

SPINNING PROCESS. T. G. Finzel and G. F. D'Alelio (to Industrial Rayon). U. S. 2,515,206, July 18. Dissolving acrylonitrile tripolymer in a nitroalkone, and extruding into a shaped article in a bath containing an aromatic hydrocarbon.

ROSIN. B. L. Hampton (to Glidden). U. S. 2,515,218, July 18. Polymerizing rosin using activated earths.

EXTRUSION. G. A. Lyon. U. S. 2,515,243, July 18. Apparatus for formation of plastic sheets.

RESIN SOLUTIONS. O. R. McIntire (to Dow Chemical). U. S. 2,515,250, July 18. Feeding molten thermoplastic to a mixing zone, feeding into said zone a soluble gas at superatmospheric pressure and mixing and cooling.

EXTRACTION. H. A. Reehling (to Armstrong). U. S. 2,515,265, July 18. Extraction of plastic products from linoleum cement.

POLYMERS. D. L. Schoene (to U. S. Rubber). U. S. 2,515,318, July 18. Polymerized of 2-substituted thiazoles.

COATED PAPERBOARD. H. C. Fisher and B. F. Sooy (to Gardner Board). U. S. 2,515,340, July 18. Applying a plasticizing film to a paper web, imprinting a mineral coating thereon with a starch binder, and adding a thermosetting resin to resist wet-rubbing.

PLASTIC COMPOSITIONS. E. H. Schwencke. U. S. 2,515,382, July 18. A polyvinyl resin, a polyvinyl chloride-acetate copolymer resin and a hydrocarbon plasticizer.

CELLULOSE ACETATE. D. Finlayson and A. W. M. Cooke (to Celanese). U. S. 2,515,402, July 18. Shrinking stretched cellulose acetate fibers with diethyl ketone.

POLYPEPTIDES. D. S. Kahn. U. S. 2,515,515, July 18. Forming polypeptides by irradiating with light an aqueous solution containing a diketopiperazine and an aliphatic peptide.

POLYMERIZATION. D. F. Gould (to Allied Chemical). U. S. 2,515,646, July 18. Subjecting a non-polymerizable hydrocarbon oil containing styrene, coumarone or indene to polymerizing action of stannic chloride and acetic or formic acid.

ACRYLIC COMPOUNDS. C. E. Barnes and W. O. Ney, Jr. (to General Aniline). U. S. 2,515,686, July 18. Composition adapted to be mass-polymerized to a colorless polymer consisting of an alpha halogen substituted acrylic acid derivative containing an inorganic acid ester of a saturated alcohol.

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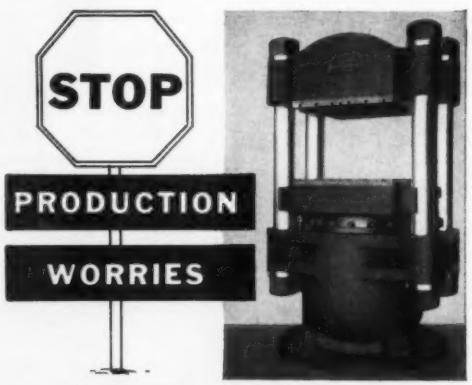

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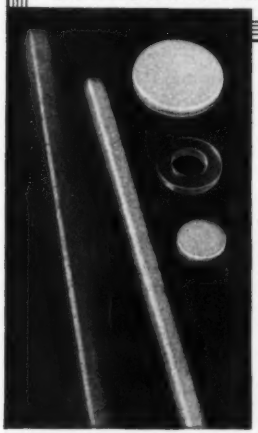

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NEW MACHINERY AND EQUIPMENT

BALL MILL GRINDING MEDIUM—Greater grinding speed, substantially longer life, and considerably reduced mill charge contamination are the major attributes claimed for a new non-metallic ball mill grinding medium developed by U. S. Stoneware Co., Akron, Ohio. Called Borundum, the tough, heavy, hard material resembles synthetic sapphire in composition. Borundum is said to weigh 75 to 80% more and to be 50% harder than conventional media. Borundum is supplied in tubular shape to provide greater contact area and is dense and non-absorbent with a white, smooth, easily washed surface.

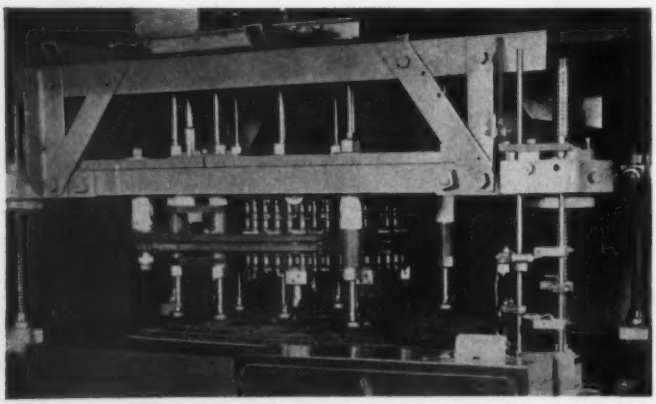
AUTOMATIC CONTOURING MACHINE—Versatile shaping of fibrous and non-shearable materials is accomplished on a new machine, the Rapidfactor, announced by Richard B. Luckenbach, 2403 Franklin Ave., Secane, Pa. The Rapidfactor—whose operation is based on a number of cutting tools traveling around a master form—is said to eliminate layout, scribing, and bandsawing. In some cases, it will eliminate finishing, since it will produce a commercially acceptable finished edge regardless of the size of the piece being cut. The unit has a minimum production rate of 300 pieces per hour per inch of material thickness.

Master forms or guides are easily made from two pieces of ½-in. thick Masonite die stock. The cutting element involves standard 1-in. pitch roller chain, two take-up links, and a number of toolholder assemblies. The Rapidfactor can accommodate 20- by 40- by 2½-in. stock.

HEATER POWER GENERATOR—A new electronic power generator for medium-power dielectric high-frequency heating applications in many fields has been introduced by the Engineering Products Dept., Radio Corp. of America, Camden, N. J. Designated the 15-CH, the completely self-contained unit is capable of developing a power output of 18 to 21.8 kw. at frequencies of from 5.5 to 41 megacycles. The HF output is obtained from a stabilized, self-excited oscillator employing two RCA heavy-duty, air-cooled power tubes supplied with high-voltage DC by a three-phase, full-wave rectifier. The power tubes have a rated anode input of 32 kw.

The frequency of the new generator can be continuously adjusted by means of two interchangeable tank inductances and a movable shorting bar on the inductances. The tank circuit efficiency has been greatly increased through the use of vacuum-type loading capacitators across the tank inductances, thus assuring improved stability when the generator is operated with very low power-factor loads. An added improvement is to be found in increased safety factors.

Power requirements for the new unit are: line voltage, 230v. ±10%; line current, 100 amp. (max.); frequency, 50/60 cy.; 3-phase supply.



POSITIONING TABLE—Studies conducted by The Hamilton Tool Co., Hanover at 9th, Hamilton, Ohio, disclose that accurate "positioning" of tools and materials results in pronounced increases in production, greater safety, fewer rejects, and less damage. With this in mind, the firm has developed a positioning table which maintains stock at machines in proper position for feeding with a minimum of handling, and places and removes heavy dies and tools.

In a specific application, the table serves several machines, and is moved as required by an overhead crane. Positioning, relative to each machine, is accomplished by the insertion of four false legs into prepared holes in the floor. The table is electrically elevated or lowered to desired positions for transfering dies to the machine. Dogs, travelling across the face of the table, are then energized, and dies to be transferred are accurately "positioned" in the machine. The table weighs 5500 lb., has a capacity lift of 50,000 lb., measures 60 by 96 in., has minimum height of 21 in. and a maximum height of 31 inches.

SOLVENT RECOVERY SYSTEM—Vapor solvent processing has been reduced in cost to fractions of a penny a pound by a new system—the result of combined efforts by The Patterson Foundry & Machine Co., 41 Helene St., E. Liverpool, Ohio, and Pittsburgh Coke & Chemical Co., 1905 Grant Building, Pittsburgh 19, Pa. Known as the Patterson-Pittsburgh Solvent Recovery System, the process was designed and built by Patterson, while Pittsburgh supplies the durable, activated carbon used in the system.

The system can be set up for automatic, semi-automatic, or manual

NEW! VAN DORN 2-ounce Injection Press

Utilizing the same rugged construction with doubled capacity, this Van Dorn press now offers you more profitable production with molding time reduced 30% to 50%. The new press has a larger heating cylinder with more plasticizing capacity; greater injection pressure; faster cycling due to larger motor and pump; and a unit for cooling hydraulic oil.

Surprisingly low in price, this versatile press uses inexpensive molds, can be set up by one man in 20 minutes, and operates 8 hours for under 1 dollar!

With all these features, this remarkable press is *unequalled* in the 2-ounce capacity class for molding practically all thermoplastics, including nylon.

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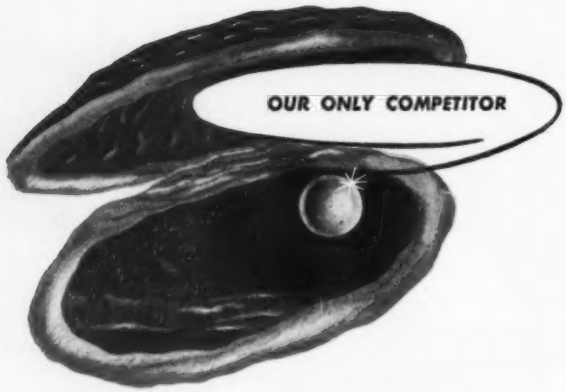

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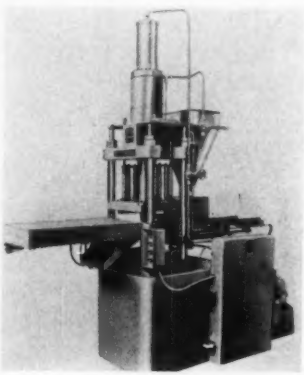
operation. In many cases, idle plant processing equipment can be adapted to the system, thus reducing the initial outlay for installation. The process can be modified to handle two general classes of solvents—water insoluble and water soluble or mixed.

MOLDING PRESS—Both thermosetting materials and fast-curing alkyd compounds can be molded on the new No. 741 dual purpose plastics molding machine recently announced by F. J. Stokes Machine Co., 5900 Tabor Rd., Philadelphia 20, Pa. By merely operating two valves, the conversion from one type of molding to the other can be made in a few seconds.

The fully automatic unit has a capacity of 50 tons with a 15 by 13-in. platen area, when using conventional materials; for high-speed



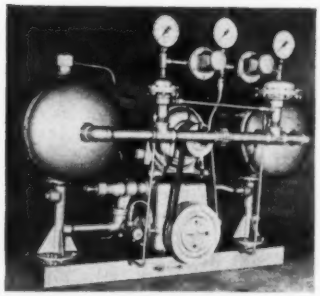
alkyd molding, it has a capacity of 24 tons and a fast closing speed of 240 in. per minute. For protection of the mold, this rate is reduced a split second before the force enters the mold.

IMPROVED PACKING—Greater flexibility, extra economies, and easier identification have resulted from the addition of a securely vulcanized tape-back to the Super Seal Spiral Plastic Packing produced by Crane Packing Co., Dept. Q-1, 1800 Cuyler, Chicago 13, Ill. An integral part of the packing, the tape-back reinforcement simplifies ring cutting, since the spiral can be twisted down to small shaft sizes and then cut.

The problem of distinguishing packing styles has been solved by

clearly marking the tape-back of each Super Seal style in a different color. The packing line is furnished in six styles. Packings are composed of asbestos, anti-frictional metal particles, flake graphite, and special binders. They do not harden at elevated temperatures and need not be removed as wear occurs; adding another ring to the stuffing box will maintain leak-proof service.

POWER SOURCE FOR PRESS—Dual pressure for hydraulic molding presses is provided by a new power



source, the Rialto, introduced by Oracle Engineering & Sales Corp., Tucson, Ariz. The heart of the pumping unit is a bypass sleeve, actuated in and out of pumping position by a snap action regulator control valve. Two separate pumping sections develop individual pressures providing for low pressure rapid-advance volume and high pressure liquid for dwell time. Line pressures from 0 to 6000 p.s.i. may be obtained by regulating air pilots. The model 200 Rialto is available in six sizes. It will pump water, oil, or other media and will operate wherever ventilation is sufficient for an electric motor.

PRESS PUNCH—Machining of plastics is said to be considerably accelerated by the adaptation of an electrically heated punch to a stock model Arbor press manufactured by Dake Engine Co., 390 Monroe St., Grand Haven, Mich. The new fixture transmits heat under thermostatic control to plastic forms during punching operations. It is a time saver in that it simultaneously heats and punches plastics of widely varying widths. A felt-lined jig guards work against damage.

POWER SHEAR—Designed to reduce labor costs in operations involving slow-cutting materials is the new Jacques semi-automatic power shear introduced by Hobbs Mfg. Co., 46 Salisbury St., Worcester 5, Mass. Up to 70 cuts a min. can be made on such materials as plastics, paper, foils, laminations, and rubber. Additional production speed is achieved by versatile feed, receiving, and cut-actuating set-ups.

Material can be either sheet fed or fed directly from the roll. The cutting head can be mounted directly into a production line, as a part of a continuous process, or as a finish trimmer. It can be actuated by hand or foot switch, or controlled automatically by feed-roll actuator, photo-electric cell, or mechanical ticklers. The shear is made with a 50-in. cut. An automatic, foot-operated clamp and safety device holds material securely during cut.

DRILLING-TAPPING UNITS—Low cost and high speed are among the principal merits claimed for a precision automatic drilling and tapping unit manufactured by HyPneuMat, Inc., 647 W. Virginia St., Milwaukee 4, Wis. The unit, which utilizes hydraulic or pneumatic power, offers one-stroke or continuous cycling, has a rotating and reciprocating spindle, and permits speeds up to 20,000 r.p.m. Other highlights include drilling and tapping capacity of ⅜ in. in steel; a ⅛ to 3½-in. stroke; automatic cycling; infinitely adjustable feed; adjustable stroke for both directions; variable spindle speed; automatic, hand, or foot control; and dwell action adjustable from 0 to 120 seconds.

AIR VALVE—Quick, positive control of small cylinder operation is the major objective of a new air valve, the 880 Series, announced by Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3, Mich. Flexibility is attained by interchangeability of parts. The unit can be supplied with the following accessories: a vertical handle, with or without spring return; horizontal handle, with or without spring return; double treadle foot lever; and single treadle foot lever with spring return. The valve is available in three- or four-way models with ¼- and ⅜-in. pipe sizes.

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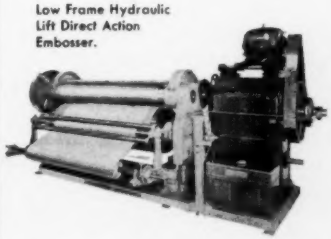

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"British Plastics Year Book, 1950"

Published by Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E. 1, England. Price 30 shillings.

The 20th edition of this comprehensive buyers' guide to the plastics industry contains the following sections: general—a review of patents of the preceding year; materials—molding materials, solvents, plasticizers, and a list of the firms producing them; manufactured products—goods molded and fabricated from plastics materials, with manufacturers' names; plant and equipment; glossaries—proprietary and trade names and technical terms; names and addresses of firms, consultants, and designers; who's who in the plastics industry; associations and federations connected with the plastics industry; and technical and general data.

"Elastomers and Plastomers. Vol. I" Edited by R. Houwink

Published by Elsevier Publishing Co., Inc., 215 Fourth Ave., New York 3, N. Y. 490 pages. Price $7.00.

Chemistry, physics, and technology are covered, with an introductory survey of the economic position of plastics, rubber, fibers, protective coatings, and drying oils. The book gives data, references, formulations, etc., on synthesis of macromolecular compounds; reaction kinetics and mechanism of polyreactions; molecular constitution; mechanical properties; mechanical operations such as coating, molding, extrusion, etc.; polymer-liquid interaction; and plasticizers, including methods for evaluating efficiency and special types of plasticization.

"Cellulose Acetate Plastics" by Vivian Stannett

Published by Temple Press Ltd., Bowling Green Lane, London, E.C.1, England. 325 pages. Price 30s.

Although cellulose acetate is rated by the author as the most versatile of all the synthetic and natural plastics in methods of application, the publishers believe the present work to be the first complete volume presenting the simple facts about the material's properties and technique of handling. It is pointed out that acetate's growth has been characterized by the diversity of products into which it has found its way and the variety of methods used in their production. Numerous tables and illustrations are liberally sprinkled throughout the text which covers such topics as history and statistics; the manufacture of cellulose acetate film, sheeting, and molding powder; properties of cellulose acetate; fabrication and finishing; container production; uses.

"Report of Symposium on Wood" PB 101 233.

Published by Office of Technical Services of the U. S. Dept. of Commerce, Washington 25, D. C. 537 pages. Price $7.50.

Originally prepared under the joint sponsorship of the Office of Naval Research and the National Research Council, the collection includes 24 presentations dealing with wood research by the armed services; the mechanisms of wood lignification and deterioration; utilization of wood for packaging, as a construction material in timber or "sandwich" form, and as conversion products; and wood requirements for aircraft, shipbuilding, and other fields. A number of papers deal with fungus and insect problems.

"Introduction to Textile Chemistry" by Bruce E. Hartsuch

Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 413 pages. Price $4.75.

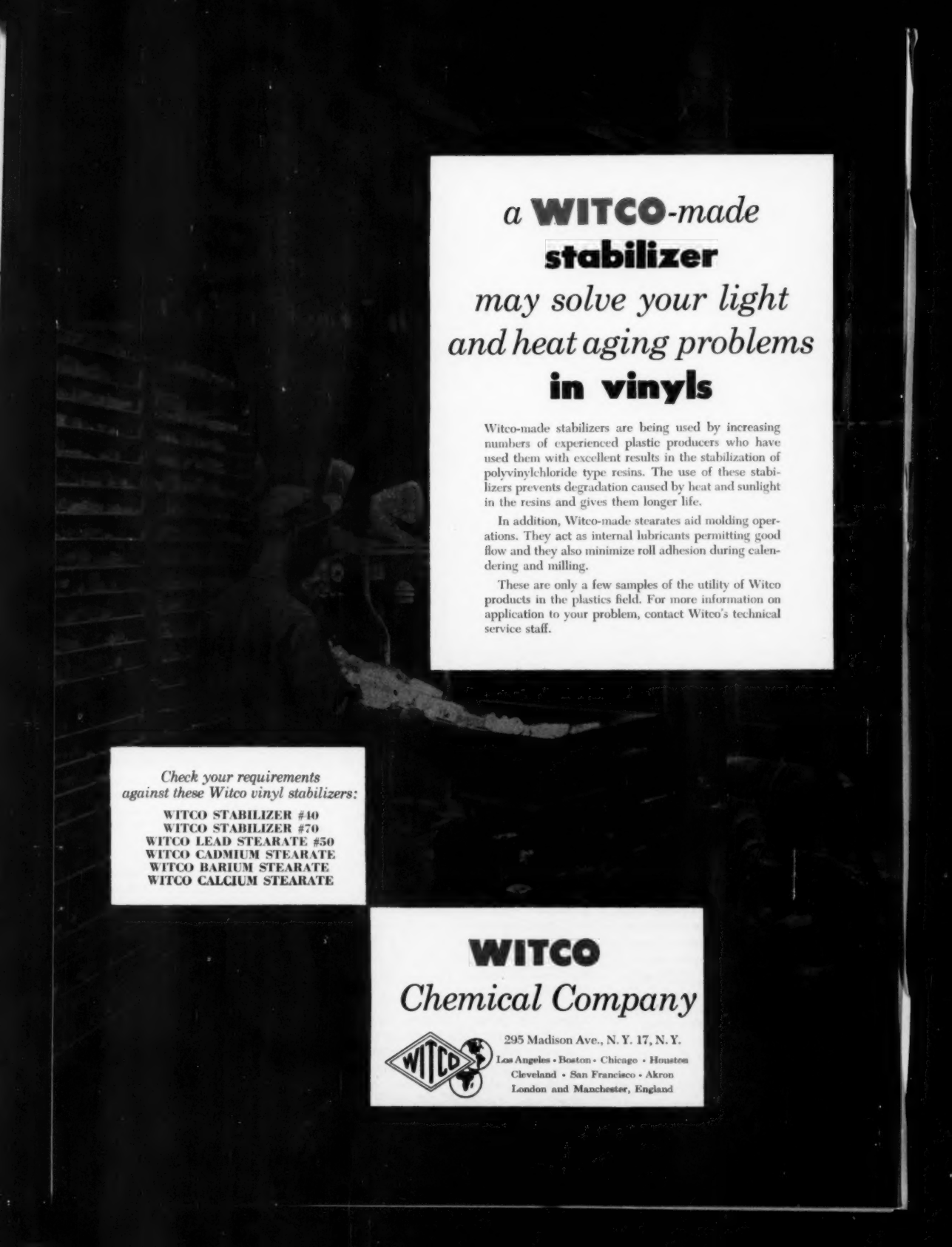
Designed especially for the student and teacher who are familiar with the chemical foundations of the textile field, this book is also intended for the technologist and specialist whose knowledge of chemistry is limited. It aims to give those interested in this subject the necessary background for an understanding of the content, construction, and behavior of textiles. Emphasis throughout is on the chemistry of the raw materials which make up textiles as we know them. Sufficient material on organic chemistry is presented to acquaint the reader with terms and equations, and a glossary of terms used in the textile chemistry field is included. Individual chapters are devoted to cotton, wool, silk, rayon, and nylon; the man-made polymerized and protein fibers are discussed in separate chapters.

Socket screws—The company's small wire-size multiple-spline socket cap screws and set screws are illustrated in this six-page bulletin. Included are specifications and prices of socket head cap screws, in sizes as small as No. 2 wire size, and set screws. *The Bristol Co., Waterbury 20, Conn.*

Activated carbon—Vapor and liquid phase adsorbent applications of granular and pulverized activated carbons are discussed in this new 10-page booklet. Presented are the comparative advantages of using the two types of carbons and their various grades; production and research involved; and typical examples of the uses of each type. *Pittsburgh Coke & Chemical Co., 1959 Grant Bldg., Pittsburgh 19, Pa.*

Hydraulic tube fittings—Both the flare and no-flare types of the firm's improved line of tube fittings for industrial use are covered in this 12-page catalog. Exclusive design features include: alloy steel spring sleeve; cantiliver spring fingers; and short radius swing. Drawings of fittings and complete engineering specifications are given, together with recommendations for tubing and wall thicknesses to hold desired working pressures. *Flodar Corp., 331 Frankfort Ave., Cleveland 13, Ohio.*

Phenolic resins for the Croning process—The Croning or "C" process for producing foundry molds and cores has received wide attention in the foundry industry; its advantages include increased production, reduced cost, and improved quality. The use of phenolic resins for producing molds and cores by this method is described in this 16-page booklet which contains fundamental information supplementing a step-by-step photographic



a **WITCO**-*made* **stabilizer** *may solve your light and heat aging problems* **in vinyls**

Witco-made stabilizers are being used by increasing numbers of experienced plastic producers who have used them with excellent results in the stabilization of polyvinylchloride type resins. The use of these stabilizers prevents degradation caused by heat and sunlight in the resins and gives them longer life.

In addition, Witco-made stearates aid molding operations. They act as internal lubricants permitting good flow and they also minimize roll adhesion during calendering and milling.

These are only a few samples of the utility of Witco products in the plastics field. For more information on application to your problem, contact Witco's technical service staff.

Check your requirements against these Witco vinyl stabilizers:

WITCO STABILIZER #40
WITCO STABILIZER #70
WITCO LEAD STEARATE #50
WITCO CADMIUM STEARATE
WITCO BARIUM STEARATE
WITCO CALCIUM STEARATE

WITCO
Chemical Company

295 Madison Ave., N. Y. 17, N. Y.
Los Angeles • Boston • Chicago • Houston
Cleveland • San Francisco • Akron
London and Manchester, England

description, together with recommendations for producing patterns, molds, and cores. *Bakelite Div., Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Two stabilizers—Two technical service reports covering new additions to the company's line of stabilizers are now available. The first discusses a cadmium type light and heat stabilizer for polyvinyl chloride type resins, called #40, which is recommended for stabilization of transparent film, sheeting, and extruded compounds where the highest protection is required. The second, #70, cadmium-barium type, is also for polyvinyl chloride type resins and is said to combine the qualities of cadmium and barium fatty acid soaps and provide resistance to both heat and light for general applications. *Witco Chemical Co., 295 Madison Ave., New York 17, N. Y.*

Resorcinol glue—Cascophan, a liquid resorcinol resin adhesive, is described in this folder as the only type of cold-setting wood glue to meet the newest military specifications for water-proof, boil-proof bonds. Suggested applications for use by amateurs include weather-proof bonds for boat-building, outdoor furniture, and other critical wood gluing. Both household and production gluing instructions are included. *The Borden Co., Chemical Div., Dept. PR, 350 Madison Ave., New York 17, N. Y.*

Plastics research and technology—The activities of the National Bureau of Standards in the field of plastics since 1917 is summarized in this 14-page circular. The experimental program, consisting largely of investigation of the properties and physical constants of plastics, is presented under the following headings: properties, testing, materials, applications, specifications, general information, and an investigation of German technology. A bibliography of 160 publications from the Bureau is included. The booklet, Circular 494, is available for 15¢ from *Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.*

Rubber putty—The advantages of Plastikon rubber putty and its suggested uses are set forth in this catalog section, along with directions for use and lists of stock colors and grades. The putty is recommended for many types of glazing and sealing, particularly where vibration, corrosion, and moisture exists. *The B. F. Goodrich Co., Akron, Ohio.*

Saran lined steel pipe—Properties and fabrication of saran-lined steel pipe, fittings, and valves are covered in this new catalog discussing this application of Dow's saran. Photographs and cross-sections in addition to dimensional drawings, supplement the text. *Saran Lined Pipe Co., 2415 Burdette Ave., Ferndale 20, Mich.*

Hydraulic oil accumulators—A new line of accumulators for industrial machinery hydraulic control systems is covered in this four-page bulletin, No. 50-56. These accumulators are designed to supplement operation of any of the company's vane or piston pumps in circuits with intermittent high pressure requirement. An unusually high safety factor at 3000 p.s.i. operating pressures is achieved by unique swedged neck connection and one-piece, seamless alloy steel shell construction. The units are available in five models with capacities ranging from 75 to 2050 cubic inches. Standard accessories, including gage and adapter assembly, precharging, and gaging hose assemblies, are also listed. *Vickers, Inc., 1446 Oakman Blvd., Detroit 32, Mich.*

Extruded plastics—Written especially for executives, engineers, designers, and purchasing agents, this eight-page brochure explains the many forms of plastic extrusions. Photographs and sketches of components fabricated for a wide variety of industrial and consumer products show the possibilities of this processing technique. A compact table of the properties of the thermoplastics is included. *Anchor Plastics Co., Inc., 533 Canal St., New York 13, N. Y.*

Laboratory press — Improvements and refinements in the latest Carver hydraulic laboratory press are described in this new catalog which provides information on this research and development unit designed for quick, accurate small-scale tests. Following a consideration of the many applications of the press, accessories are described, including hot plates, test cylinders, cage equipment and plate and cloth equipment, and swivel bearing plates. A listing is given of Carver press users, by states. *Fred S. Carver Inc., 343 Hudson St., New York 14, N. Y.*

United States Government Procurement—Offered as an aid to manufacturers in obtaining Government business is this 16-page brochure containing accurate, up-to-date information relative to Government purchasing and all aspects of the procurement picture. An introductory section explains the various methods of procurement and advises bidders on how to obtain information on products or services they have to offer. Another section deals with common errors in bidding. "Helpful hints" are offered in answer to such specific questions as how to bid on specification items; how to figure discounts and liquidated damages; how to qualify bids without being disqualified; how to bid on all items without running the risk of a "single item award"; and other pertinent information. *Trilane Associates, Inc., 1 Hudson St., New York 13, N. Y.*

Research facilities without capital investment—The function of the chemical consultant in today's industrial research is explained in a 20-page brochure released by a firm of consulting chemists and engineers. Answers are given to such questions as: "Why use a consultant? What is research? What can research buy?" *Foster D. Snell, Inc., 29 W. 15th St., New York 11, N. Y.*

Technical data on mixing and agitation—Accumulated data on mixing research, tested operating applications, and the experience of mixing specialists has been compiled in a simple technical chart, designated T-1, to assist engineers and operating personnel in checking power requirements for liquid agitation of most types. A companion piece to this graph is a bulletin describing custom built mixing and agitating equipment for liquid, semi-plastic, and dry powder mixing. *Process Industries Engineers, Inc., 5941 Baum Blvd., Pittsburgh 6, Pa.*

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CLEAR TO SEE. You sell it . . . send it . . . without even opening the package. That's what dealers do who carry glasses in handsome nest units with tops and sides of tough, crystal-clear Kodapak Sheet. Shoppers feast their eyes; know what they're buying. Merchandise stays clean and bright—protected from store stockroom to home shelves.

Two basic forms of Kodapak Sheet are available: Kodapak I Sheet, cellulose acetate, gauges up to 0.060″; Kodapak II Sheet, cellulose acetate butyrate, gauges up to 0.002″. Both are made under the same rigid conditions and to the same high standards as Kodak photographic film base.

If you wish further information about Kodapak Sheet, its fabrication, and end uses, consult your nearest representative, or write Kodak. If your problem is particularly complicated, a day or two in the Kodapak Demonstration Laboratory in Rochester will prove helpful.

Cellulose Products Division, Eastman Kodak Company, Rochester 4, N. Y.

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New York, Chicago.

District sales representatives:
Cleveland, Dallas, Philadelphia, Providence.

Pacific Coast distributor:
Wilson & Geo. Meyer & Co., San Francisco, Los Angeles, Portland, Seattle.

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INTERNATIONAL PLASTICS NEWS*

Activities Around the World of Interest and Importance to the Plastics Industry in the United States

England

Expansion of chemical plants—To cover costs of vast expansion programs, four large British chemical firms have recently sought approximately $86 million additional finance. Of this, about $50 million has been raised by Imperial Chemical Industries for general expansion programs, including participation in projects for the production of refined petroleum and petroleum derivates. This makes a total of nearly $100 million raised by I.C.I. since the war.

The Distillers Co. Ltd., raising almost $25 million, has extensive plastics interests in British Geon Ltd., British Resin Products Ltd., British Industrial Solvents Ltd., and (through British Petroleum Chemicals Ltd.) in the new Forth Chemicals Ltd., formed to produce styrene monomer at Grangemouth, Scotland. A 50% increase in polyvinyl chloride capacity will shortly come into production at the British Geon plant at Barry, S. Wales.

Bringing the new chemicals-from-oil plant at Partington, near Manchester, into operation has proved more costly than expected, and Petrochemicals Ltd. is borrowing a further sum of about $7.5 million. The Catarole cracking process, claimed to be the first of its kind in the world, is already successfully launched. The gas plant is now capable of producing the separated gases for the ethylene and propylene conversion plants soon to be started up. One of the products will be styrene monomer.

Silicones are to be made in a new British plant to be erected by Albright & Wilson Ltd. in association with Dow Corning Ltd., newly-formed British subsidiary of Dow Corning Corp., U.S.A. Albright & Wilson, which now acts as Dow agent in the United Kingdom, has increased its capital from approximately $10 million to about $13.5 million. Another project by this firm is a phosphorous plant which will cost about $2.5 million, hoped to be in production by 1953.

Plastics in footwear—Two interesting footwear developments were revealed at the British Shoe & Leather Fair. The first is that a leading leathercloth organization has produced a prototype of a men's slipper with a polyvinyl chloride upper. The second is that synthetic pigment finishes, already widely used by the leather industry, are now being applied to suede leather. One example, by Lankro Chemicals Ltd., Eccles, Manchester, consists of an acrylate resin binder for specially prepared suede pigments. The solution, which can be sprayed in the normal way, is made up of 1 part resin, 1 part pigment, and 40 parts of water, and it is claimed that in addition to the fixing effect it also improves the nap. Another prototype announced in England is the nylon mesh upper for ladies' shoes by Manfield & Sons Ltd.

Spectacle lenses—Official recognition has been given to plastic lenses for the first time by the National Health authorities with the adoption of two types as alternatives to glass lenses. The lenses are of a polymethylmethacrylate resin, precision molded in polished stainless steel dies by Combined Optical Industries Ltd., London, W. 14. The refractive index is 1.490, as against 1.52 for glass.

Protective clothing—After two years of development work, R.F.D. Co. Ltd. (Protective Industrial Clothing Div.), Godalming, Surrey, has marketed a new range of polyvinyl chloride-proofed cotton clothing weighing only 8½ oz. to the square yard. Extremely flexible, resistant to abrasion and tearing, the material is impervious to most acids, alkalis, oils, greases, and many other chemicals. Because plain stitched seams permit chemical penetration, and thermal or plastic seams lack the required strength, a new method of seam sealing has been adopted. Seams are first double sewn for strength and then sealed with a specially formulated chemical film having the same properties as the clothing itself. Ventilation holes are avoided, breathing being achieved through the normal openings, assisted by the wearer's movements in generously cut styles.

World Tour—To study conditions in the plastics industry throughout the world, R. E. G. Windsor, managing director of R. H. Windsor Ltd., London, England, recently started on a tour which will include India, Pakistan, Australia, Japan, and the United States. The study is being undertaken on behalf of his company's business in manufacturing injection molding, extrusion, and other plastics processing equipment. A separate Windsor sales company has been set up in Pakistan to provide on-the-spot technical service for plastics producers in that country. In Sydney, Mr. Windsor visited the leading Australian molders; at Tokyo he held discussions with leading plastics firms and presented an address before the Plastics and Rubber Society. He is due in San Francisco on Nov. 8, and will cross the United State via Chicago to New York.

Standards for inserts—Work undertaken by the British Plastics Federation on the preparation of standards and a code of practice for the commoner inserts used by plastic molders is specially mentioned in a report on "Simplification in British Industry" issued by the Anglo-American Council on Productivity. The object is to help reduce the multiplicity of types made and the large stocks of inserts which molders now have to hold.

Vinyl tank linings—Nutravic, a completely unplasticized polyvinyl chloride is being successfully used by Tanks & Linings Ltd., Driotwich, for lining tanks in difficult locations and for lining wooden vats. The material is similar to Vinidur, de-

(*Continued on p. 149*)

*Reg. U. S. Pat. Office.

FIBERGLAS* REINFORCEMENTS + PLASTICS = profits!

...and here's the proof!

MOLDER:

Apex Electrical Manufacturing Company, Cleveland, Ohio

MATERIAL:

Polyester resins reinforced with Fiberglas strands.

PRODUCTS:

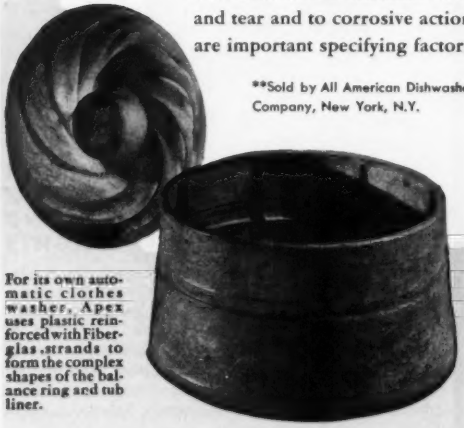
Tub and lid for All American Automatic Dishwasher**... Balance ring and tub liner for Apex automatic clothes washer.

results:

INCREASED SALES! GREATER PROFITS! New design latitude permits improved performance at lower cost. Dimensional stability ... resistance to household wear and tear and to corrosive action ... are important specifying factors.

**Sold by All American Dishwasher Company, New York, N.Y.

Tub and lid of this All American Automatic Dishwasher are molded by Apex from tough, corrosion-resistant plastic, reinforced with Fiberglas strands.



For its own automatic clothes washer, Apex uses plastic reinforced with Fiberglas strands to form the complex shapes of the balance ring and tub liner.

Investigate these new engineering materials and cost-saving processing techniques for your products!

*Fiberglas is the trademark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

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Plastics Division, Dept. 876
Nicholas Bldg., Toledo 1, Ohio

Please send me more information about Fiberglas-reinforced plastics.

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TITLE .....

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Hold Mold Temperatures Within 2°-F.

with

THERMOLATOR CONTROL

Photo Courtesy Hydraulic Press Mfg. Co.

Benefits You Can Have Through This Close Control of Mold Temperatures:

- **Faster Cycle**
- **Reduced Scrap**
- **Improved Surface Finish**
- **True-To-Dimensions Products**

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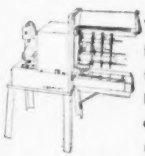
Are excellent for marking with stamps, brushes, fountain pencils and machines. All standard colors are available..



The machine shown uses liquid ink for printing trade-marks and numbers on plastic tubes and rods. A hopper fed marking machine built by the makers of hot stamping machines and a full line of plastic marking equipment.

Write for Full Details
The ACROMARK Company
5-15 MORRELL STREET ELIZABETH 4, N. J.

veloped during the war in Germany, but since improved upon in production and fabrication. The lined tanks can be sterilized with live steam.

Holland

The origin, purposes, and organization of the Plastics Research Institute T.N.O., Delft, Holland, have recently been outlined by the Industrial Information Dept. of that organization.

The Plastics Research Institute T.N.O. was established in 1946 as a section of the National Council for Industrial Research T.N.O.[1], which already had sections for textiles, paper, rubber, leather, packaging, paint, wood, metal, etc.

The purpose of the Plastics Research Institute T.N.O. is to stimulate the development of industries producing or dealing with plastics. The Institute performs all kinds of research on the applications, fabrication, and testing of plastics. In addition to its pure scientific research, which is subsidized by the government, the Institute is equipped to carry out research for industries on a fee basis.

The Institute is divided into six departments. The Scientific Dept. investigates fundamental problems such as the physical and chemical behavior of polymers, thermodynamical properties of polymeric substances, etc. The Scientific Technology Dept. tests raw materials and carries out development work on new polymers. The Industrial Research Dept. carries out practical research work to answer problems submitted to the Institute by industry. The Mechanical Testing and Chemical Analyzing Dept. conducts mechanical tests of plastics and of finished products and develops new testing methods. This unit is also concerned with developing national and international standardization of testing methods. The Dept. for Documentation and Patents keeps the other branches informed of recent developments reported in the world's literature. It also handles all matters relating to patents. The Industrial Information Dept. collects statistical data, performs market research, and handles the public and industry relations of the Institute.

The work of the various departments is coordinated by a planning commission made up of the chiefs of the departments.

The Institute, in cooperation with the British Institute of Plastics Technology, has developed correspondence courses in plastics in the Dutch language. It also maintains a permanent exhibit of plastic materials and plastics products, and disseminates sound films about plastics. A monthly journal, "Plastica," is edited by the Institute.

An idea of the extent of the Institute's activities is conveyed by the fact that it employs about 110 people. About 50% of the cost of running the Institute is borne by the government. The industrial research activities are paid for by the individuals or firms who request those services. Payment is on the basis of cost (salaries plus overhead). Information which does not involve extensive research is, however, available without charge.

Of particular interest is the fact that the services of the Institute are available to foreign firms.

[1]T.N.O. is an abbreviation of Toegepast Natuurwetenschappelijk Onderzoek, which means Applied Scientific Research.

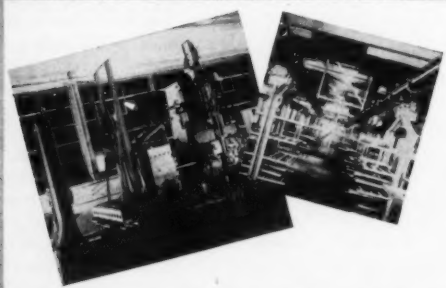
more men and machines to produce your products better!

more injection

Batteries of presses ranging from 2 ounces to 48 ounces with new presses that can take up to 300 ounces being added!

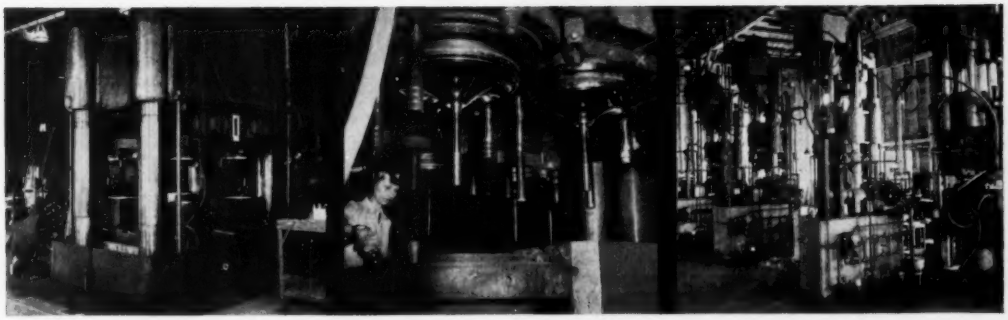
more compression

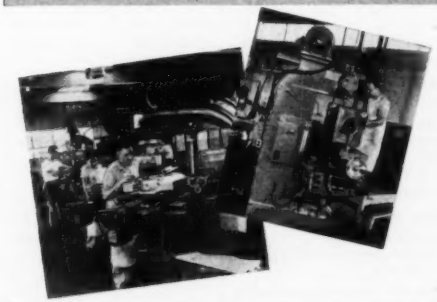
Batteries of presses ranging from 100 tons to mammoth 2,000 ton presses with 71" x 74" platen areas!



PLASTICS DIVISION
GENERAL AMERICAN

SEE General





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Send for bulletin and reprint describing results on plastics applications.
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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant, for transfer to other plants

Materials	*Total prod'n. first 7 mos. 1950*	*Total sales first 7 mos. 1950*
CELLULOSE PLASTIC:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, continuous:		
Under 0.003 gage	6,718,118	6,710,132
0.003 gage and over	5,055,303	5,133,045
All other sheets, rods, and tubes	2,457,073	2,104,837
Molding and extrusion materials	43,853,764	42,369,679
Nitrocellulose:		
Sheets	3,460,470	3,304,111
Rods and tubes	914,648	595,181
Other cellulose plastics[b]	6,660,778	6,675,715
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	38,442,709	25,825,602
Adhesives	15,965,038	14,563,351
Molding materials[a]	119,379,620	100,705,020
Protective coatings (containing less than 10% modifier)	12,218,460	9,681,528
Miscellaneous uses (covers casting)	34,606,305	34,127,455
UREA AND MELAMINE RESINS:		
Adhesives	40,210,586	38,560,585
Textile- and paper-treating resins	15,597,155	11,607,348
Protective coatings, modified and unmodified	16,279,106	13,891,679
Miscellaneous uses, including laminating and molding[a]	36,887,024	33,632,809
STYRENE AND STYRENE DERIVATIVE POLYMER AND COPOLYMER RESINS:		
Molding materials[a]	140,595,143	149,935,678
Miscellaneous uses[d]	88,736,670	25,457,289
VINYL RESINS:		
Sheeting and film, including safety-glass sheeting[a]	127,921,400	114,275,708
Adhesive (resin content)	10,070,549	9,128,630
Textile- and paper-treating resins, including spreader and calendering types (resin content)[e]	25,678,377	24,329,052
Molding and extrusion material (resin content)	64,899,774	60,193,138
Miscellaneous uses (resin content)[e]	12,942,480	7,270,726
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a, f]	31,948,120	31,993,576
Protective coatings[g]	37,455,166	36,944,075
All other uses[h]	45,217,760	112,226,852

[a] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Excludes data on protective coating resins; these data are included with miscellaneous coating resins to avoid disclosure of

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

June 1950		July 1950	
Production	*Sales*	*Production*	*Sales*
974,680	960,081	1,129,555	1,304,746
763,200	718,268	909,545	965,386
334,447	321,164	357,972	347,214
6,602,838[1]	6,344,524[1]	7,240,421	7,349,103
544,788	466,658	441,700	454,790
83,031[1]	99,545[1]	121,011	84,595
817,114	793,606	829,616	726,411
6,564,176	4,714,011	4,914,407	3,364,475
2,268,331[1]	1,932,916[1]	1,763,225	1,782,917
17,950,416[1]	15,474,725[1]	14,716,069	13,519,793
2,077,611[1]	1,685,764[1]	1,717,593	1,482,861
5,632,172[1]	6,098,527[1]	4,507,671	4,163,029
6,410,238	5,790,958	6,014,451	6,146,312
2,309,533	1,827,764	2,199,795	1,838,901
2,677,224[1]	2,159,794[1]	2,732,818	2,235,287
6,338,874[1]	5,496,351[1]	5,290,956	4,889,150
20,445,563	23,705,714	23,054,988	22,765,814
4,724,444	3,789,915	3,505,159	3,667,958
16,740,069	15,203,800	18,868,186	17,319,961
1,250,329[1]	1,233,825[1]	1,452,104	1,300,607
3,529,870[1]	3,594,731[1]	3,645,772	3,701,358
9,568,962	8,815,150	8,721,503	7,950,617
1,506,382[1]	850,753[1]	1,687,990	1,048,703
5,322,382	5,167,048	4,345,977	4,651,408
5,068,193[1]	5,400,802[1]	6,280,958	5,902,059
16,449,887[1]	16,025,249[1]	17,221,192	16,905,575

operations of individual companies. [a]Includes data for spreader and calendering type resins. [f]Includes data for acrylic, polyethylene, nylon, and others. [g]Includes data for coumarone-indene, petroleum, silicone, and other protective coating resins. [h]Includes data for acrylic, alkyd, coumarone-indene, nylon, petroleum, silicone, and others for miscellaneous uses. [1]Revised.

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AMERICAN "KC" GRINDER... in constant use over last 8 years.
PARTS REPLACEMENT COST ONLY $0.11 PER TON (including cost of periodic knife sharpening)

Typical of the many "KC" Grinders now used in plastic moulding plants, the American shown above is *proving* it's *endurance-engineered* for quality performance at minimum cost.

- Wide Hopper takes larger plastic forms without preliminary reduction.
- Accessible for changing or adjusting blades.
- Heavy plate construction, Alloy steel knives, Anti-Friction bearings in dust-tight pillow blocks.
- Capacities to 450 lbs/hr.

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Originators and Manufacturers of Ring Crushers and Pulverizers

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NOVADEL-AGENE CORPORATION

BUFFALO 5, NEW YORK

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styled by SHAW

engineered by SHAW

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SHAW

SHAW INSULATOR CO.

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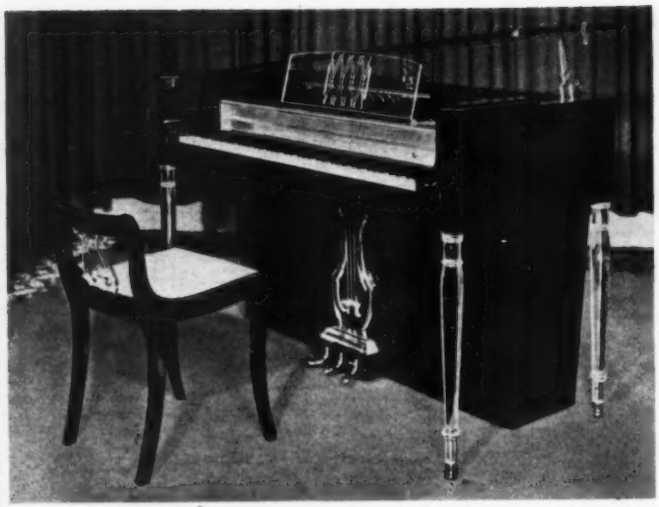


A display instrument of rare beauty results from the application of lustrous jet and clearest crystal acrylic to the frame and other parts of a fine spinet

Acrylic Piano and Chair

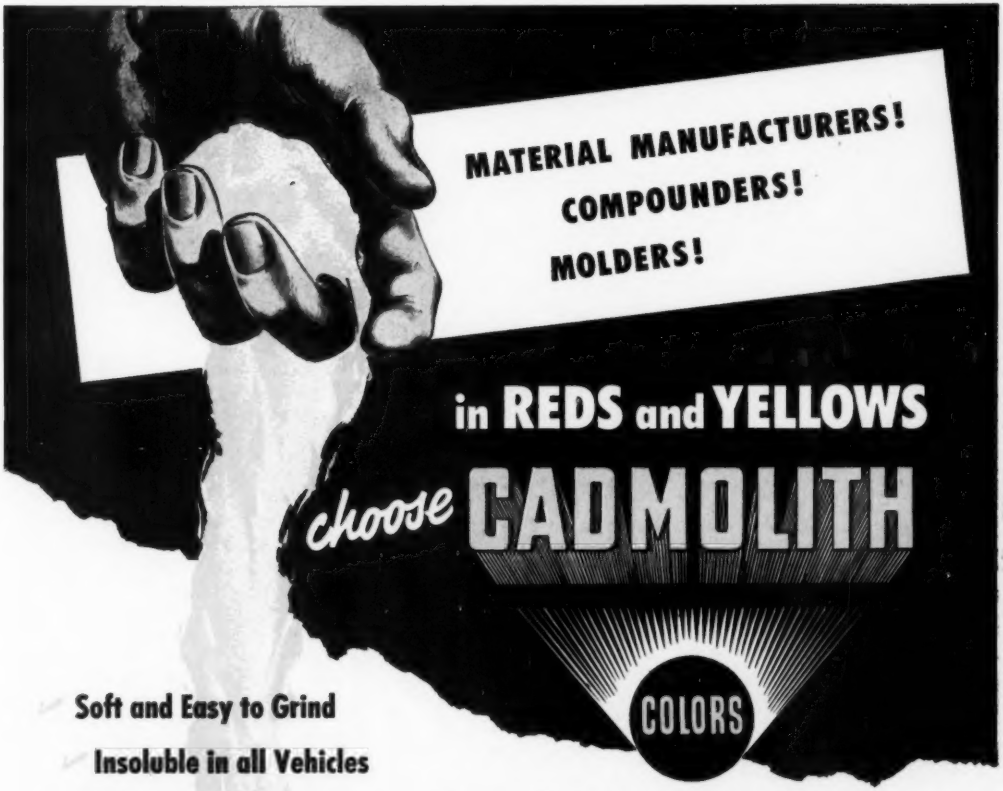
A SPINET piano having an all-acrylic housing has been produced by Scheuer Creations, Inc., New York, N. Y., on a frame supplied by Krakauer Bros., New York. The jewel-like appearance of the finished instrument results from the effective combination of deep black and crystal-clear material. Black acrylic was used for fabricating the case of the piano and the matching chair; the music rack, keyboard cover, support for top, foot pedal column, legs, and the lyre-shaped design on the back of the chair were produced in crystal-clear acrylic. Both Lucite and Plexiglas were selected for this job. The chair seat is upholstered in white vinyl.

The acrylic material provides an attractive, sparkling surface which is easy to keep clean and will remain lustrous with a minimum of care. All the accessories are made of standard materials.

This acrylic housing was built around a spinet frame of a type called the Krakauer Serenade, constructed with a closed-in back. Thus the piano need not be placed against the wall, but can stand in the middle of the room and be viewed from any angle. Special tone chambers give the instrument the tone volume of a Grand piano, and the top can be raised—both features unique to this type of spinet.

In fabricating the housing, acrylic sheet was used which ranged in thickness from ⅛ to 2 inches. Heavy solid sheets form the sides and top; thin sheets were veneered over plywood for the front and back. The sheeting was assembled on a prefabricated frame. Use of solid material on the sides, top, and in the chair facilitated the machining of edges for beveling, grooving, or to obtain trim effects to improve the finished appearance of the piano and add to its eye appeal.

During fabrication, each piece was individually heated, formed, fitted, and placed in position. Fine definitive edges were obtained on all corners by beveling to a 45° angle. Solvent-sealed joints were used throughout, the machined edges being soaked and then pressed into position. All surfaces were kept masked during construction to prevent marring the finish of the acrylic sheets, with the result that only a slight buffing was needed, on removal of the masking paper, to complete the piano for presentation.



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Glidden leadership in pigment research has produced in Cadmolith* Colors the very finest reds and yellows available anywhere—measured by every standard of importance to material manufacturers, compounders of new and old materials and plastic molders and coaters. Where a higher degree of opacity is required, *Pure* Cadmium Reds are available in the same broad range of shades as our Cadmolith* Reds.

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Model 4 — MACRAY Semi-Automatic Machine
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Write . . . wire or phone for bulletin, price and specifications.

MACRAY ENGINEERING CO.
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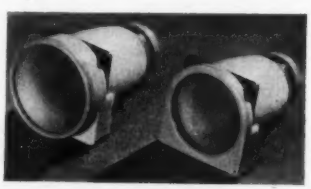
A few choice territories are available

Picture Viewer

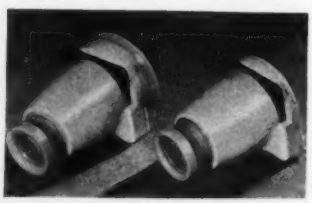
CURRENT interest in color transparencies has stimulated a growing market for viewers, one of the most recent of which, a pocket-size instrument, comes from England under the name of the Jafro Viewer.

The choice of plastics for the housing was dictated by the fact that the desired lightness and strength, color, and texture would be most economically provided in that medium. The body is made of gray wood-filled urea, and the eye piece and screen rim of red urea. Both pieces are molded by Brookes & Adams Ltd., Birmingham, from materials supplied by The Beetle Products Co. Ltd. The screen is a sheet of acetate.

First designed in 1947, the viewer underwent three slight modifications suggested by the designer, R. E. Brookes, which not only improved its performance but enhanced its appearance. The screen was moved forward out of focus to eliminate the grain of the acetate sheet which showed up slightly in the former position. A small slot was incorporated in the underside of the body so that strips of 35 mm. film could be fed through a special adaptor now supplied with the viewer. Also, the use of fine molded ribs on the eye piece made it more easily adjustable.



Acetate screen performs better as re-positioned in new model



Redesigned eye piece, left, has molded-in ribs for easy adjusting

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Can you count on uniform quality, ample supply, perfect delivery?

If you can't give an immediate "yes" to these important questions then you'd better see the men from Tennessee. We supply *good chemicals* on the *good business* basis of more service for the buyer. . . whether your orders be large or small. Request our latest price list and specifications. Better still, place an order; let us demonstrate the service you get when you order chemicals from Tennessee.

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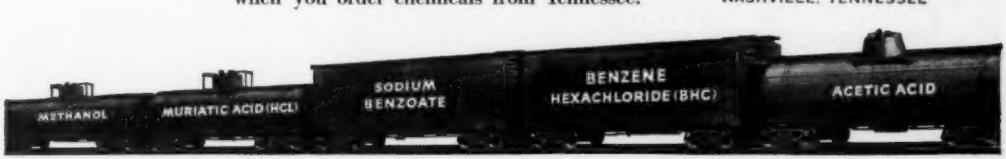

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NACROMER is an excellent substitute for Pearl Essence where cost is a factor and where the high brilliance of natural pearl is not necessary.

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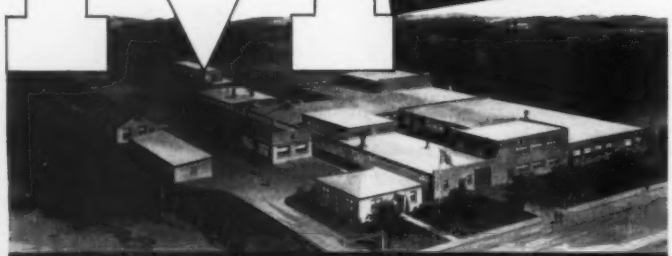

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Two-part acetate compartment at top holds hygroscopic crystals

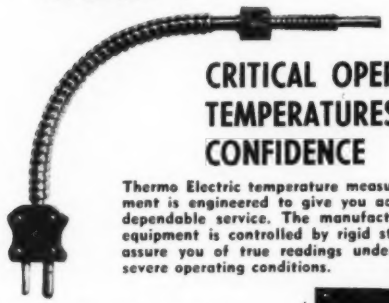
Dehumidifier

PROTECTION against damage caused by excess humidity in homes, ships, factories, and warehouses is offered by a new dehumidifying unit made of Tenite I cellulose acetate. Molded by Sulak Mfg. Co., Seattle, Wash., for Dri-Z-Air Co., also of Seattle, the product consists of an upper container which holds hygroscopic crystals and a lower catch basin for moisture drawn from the air.

Non-toxic, odorless, and non-flammable Dri-Z-Air crystals, poured into the upper chamber, attract moisture from the atmosphere. This is collected in the lower receptacle, which, when completely filled with water is emptied. When the crystal supply is to be replenished, a small brass nut is unscrewed, permitting the upper half of the top compartment to be removed.

A grillwork arrangement, permitting maximum exposure of the crystals to air, is molded into the two halves of the top compartment. The extreme toughness of the acetate makes these comparatively slender sections safe from breakage; its corrosion-proof qualities enable the unit to withstand constant exposure to moisture.

CHECK . . .



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Thermo Electric temperature measuring equipment is engineered to give you accurate and dependable service. The manufacture of this equipment is controlled by rigid standards to assure you of true readings under the most severe operating conditions.

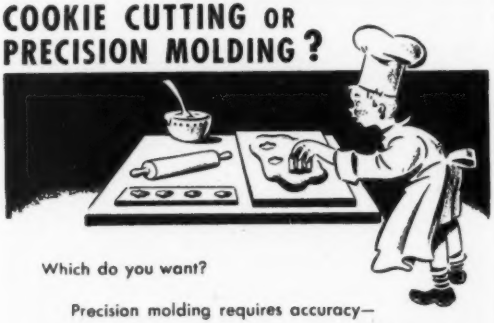
Bayonet Immersion Contact Thermocouple with Silver Tip and Quick Coupling Connector.

Send details of your application and let us recommend the proper pyrometric equipment; or, send for our catalog P describing our Thermocouples, Quick Coupling Connectors and Panels, Lead Wires and Indicating Pyrometers.

Indicating Pyrometer and Six Position Selector Panel.

Thermo Electric FAIR LAWN NEW JERSEY

COOKIE CUTTING OR PRECISION MOLDING?



Which do you want?

Precision molding requires accuracy—experience — engineering — high technical skill — complete "know how" to design your piece, work out your problems, produce your piece to your complete satisfaction.

On the other hand, cookie cutting — well!

PLASTIC MOLDING CORPORATION
Custom Molders · Precision Molders
Sandy Hook Connecticut

Cold Mold • Hot Compression • Plunger Transfer • Injection

Acheson Blacks... Concentrated carbon Dispersions

. . . in polystyrene, polethylene, ethyl cellulose, cellulose acetate, the vinyls, and plasticizers.

. . . either as a colloidalized colorant incorporated in resins, which are subsequently finely granulated for convenience, or in plasticizers marketed as readily extendible pastes.

Acheson Concentrated Carbon Black Dispersions give you a highly opaque product, with a superlatively smooth lustrous surface . . . using but a fraction of the ordinary colorant.

Acheson Dispersions are literally dustless . . . will not contaminate colors on adjacent equipment . . . minimize clean-up between runs . . . reduce processing time.

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Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. The dispersing of pigments and dyes to specification is one of our specialties. If you need this type of service, tell us about it. We may be able to help you.

For more information on dispersed pigments call or write ACHESON COLLOIDS CORPORATION, DISPERSED PIGMENTS DIVISION, 420 LEXINGTON AVE., NEW YORK 17, N. Y.

Acheson Colloids Corporation dag DISPERSIONS

ONE CUSTOMER IS MOLDING

900

CORD PLUG INSERTS PER HOUR

with a MOSLO DUPLIMATIC* Minijector

This customer is convinced that a Moslo Duplimatic Minijector molding machine is the only way to get high speed production of molded cord plugs — and at a minimum labor cost. In fact this same customer after having his first Duplimatic in operation for only two weeks placed an order for a second machine. After operating the second machine for only one week he called and placed an order for his third Duplimatic.

The Duplimatic Minijector is ideally suited for high-speed production for molding any insert. The Duplimatic is all hydraulic and completely automatic. The lower mold section has a complete duplicate set of cavities and is mounted on an automatic positioning bed. A single operator handles all operations. While one mold is being loaded the other mold is closed and receiving an injection charge. Automatic Knockout pins eject molded parts and mold is ready to be reloaded. It is available in 2 oz. and 4 oz. injection capacity with a mold casting area from 20 to 40 sq. inches with an injection pressure of 16,250 to 20,000 p.s.i. We invite your inquiry — write today for further details.

COMPARE OUR SPECIFICATIONS

Guaranteed Production Ratings

- Stainless steel, torpedoless cylinder, Patents Pending.
- Push button controls.
- Will mold all thermoplastics including vinyls and Nylon.
- Constructed of finest materials.
- Quick mold changing.
- Simple maintenance.
- Positive clamp.
- Greater versatility.
- Fast, even plasticizing.

The Complete Moslo Line Includes:

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Mix the contents of a sealed, pre-weighed package of JAMISON DRY COLOR MIX with 100 lbs. of crystal polystyrene. In 10 to 20 minutes you have standard colors . . . ready to mold!

JAMISON DRY COLOR MIXES give you:

- Consistent results . . . all ingredients carefully *pre-blended* . . . tested in over 6 years of molding-plant use.
- All standard colors . . .
- Special colors supplied on quantity orders.
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Our Export Division is always ready to serve you

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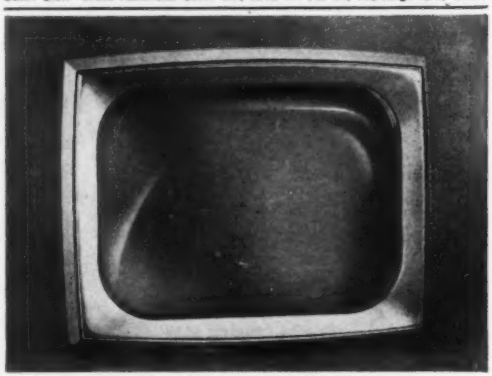


Television Lens for Admiral Radio

ANOTHER EXAMPLE OF PRECISION

CUSTOM PLASTIC MOLDING

This plastic TV lens conforms to the highest standards of visual engineering — insures absolute clarity of vision — plus beauty. Extra controlled molding technique required. Victory custom paint-sprayed, gold-finish border. Our experienced engineers and ultra-modern equipment can produce such precision jobs for you — from engineering through actual production to complex electro-mechanical assemblies on conveyor line set-up. Ask us to *prove it!*

By

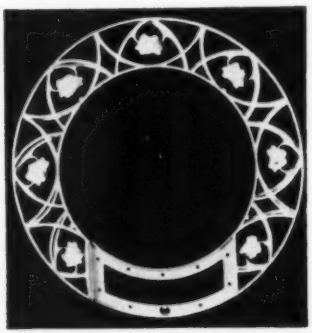
VICTORY of CHICAGO

VICTORY MANUFACTURING COMPANY

1724 W. Arcade Place, Chicago 12, Ill.

Established in 1930

Wreath is effective background for fresh or artificial flowers



Plants can be trained attractively on cut-out lattice design

Floral Wreath

A POLYSTYRENE floral wreath which is decorative in itself and which can be used again and again in a variety of ways means time and labor saved for the florist, added beauty for the housewife, and less expense for both. The wreath, which comes in white, red, yellow, or green, can be used for fresh or artificial flowers. Its continued serviceability after initial use enables the home-maker to experiment with various arrangements for her own floral displays.

Equally effective as a hanging or table decoration, the wreath adapts itself well to Christmas greens and other seasonal variations. It can also be used for growing ivy, the cut-out circle providing an attractive lattice on which to train a climbing plant.

Kusan, Inc., Madison, Tenn., molds the wreath for the floral firm of Tom Harrison, Nashville, Tenn.

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METHACRYLIC
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Plastic film

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Synthetic gums
Leather waste binders
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Logoquant is the answer when decorative coatings chip or peel from plastic parts. When properly applied, Logoquant will not chip or peel off any plastic and it withstands extreme humidity and outdoor weathering tests, too. This material is available in many colors and it may be brushed, silk screened or sprayed.

try this SIMPLE TEST

Scratch a deep "X" through your present coating. Apply "scotch" tape as shown, press down firmly and then remove tape with a jerk. A weak bond will be indicated by film adhering to the tape. We welcome this test with Logoquant. Write today for a free Logoquant-coated polystyrene chip to make any test you like.

See how Logoquant will solve your problem economically.

B

BEE CHEMICAL COMPANY

13799 South Avenue "O" Chicago 33, Ill.

Display Containers for Shirts

EVER since the first ready-made shirt was offered across the counter, the problem of how to keep the merchandise clean yet in full view of the customer has perplexed retailers. Now plastic has provided the answer. Rigid transparent boxes of styrene are now being marketed for shelf and counter displays by two companies, Result Display, Inc., 503 West 33rd St., New York, N. Y., and Visual Sales Co., Hackensack, N. J. Offering clarity which enhances the appearance of the merchandise and visibility which presells it, the boxes have gained wide acceptance in haberdashery, department, chain, and variety stores where they have been adapted for the display of such items as lingerie, pajamas, blouses, slips, and gloves, as well as men's shirts and other sundries for a male wardrobe.

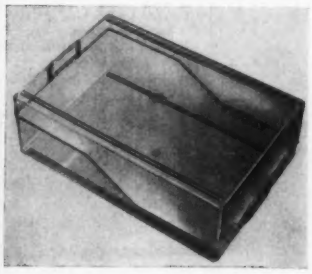
A unique feature of both display boxes is that they divide so that they can be used as two separate displays or as one closed box for storage purposes. Used either way, they have a neat, attractive appearance that adds packaging appeal to the merchandise. The sturdy construction of the boxes protects the contents from becoming shop-worn and insures the freshness and cleanliness which is necessary for this type of product in order to maintain its maximum merchandising appeal.

Result Display's product, called Double Action, is molded by Mastro Plastics Corp., Bronx, N. Y., of Styron 637, The Dow Chemical Co.'s light-stabilized styrene. The precision-molded tray, which consists of two identical parts, can be used singly as individual displays, or locked together to make one box which protects the merchandise from dust, lint, and other foreign bodies. The closed box measures 10 by 15 by 5 in., a size said to be convenient for stacking on shelves, and which permits ease of handling for both shelf and counter duty, a definite aid to clerks.

Styrene box keeps shirts clean, provides effective display unit

The other product, called the Traybox, is molded for Visual Sales Co. by Columbia Protektosite Co., Inc., Carlstadt, N. J. Like the Double Action, this box locks together to form one complete unit. But because the two trays are of different shapes, this model incorporates the additional feature of being convertible to an eye-level counter display. When the cover is inverted, it forms an easel which tilts the large counter display and angles it toward the customer at eye level, providing a hard-to-resist merchandising package.

Both the Traybox and the Double Action have molded-in slots in the front of each section in which price tags or other identifying markings can be inserted for quick and easy selection of the contents.



Identical counter display trays, below, lock together to form the closed storage box shown at left

Strategic Location...

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Serves ALL Industry
with low-cost custom-molded plastics

If you use molded plastics . . . if you are planning to use them . . . consider carefully this basic economic fact about General Industries. Located at the hub of industrial America—within 24-hour shipping distance of each of the cities shown above—General Industries *guarantees* prompt, dependable delivery of your plastics parts, as promised.

Backing up this guarantee, of course, are the extensive facilities and engineering experience which have made General Industries one of the nation's foremost producers of top-quality molded plastics.

Now is the time to get the complete story about General Industries. Send *today* for your copy of our new 16-page booklet, *Your Product in Molded Plastics.*

Just off the press . . . *new,* 16-page booklet describing General Industries' complete facilities for injection, compression and transfer molding of top-quality plastic parts.

The GENERAL INDUSTRIES Co.

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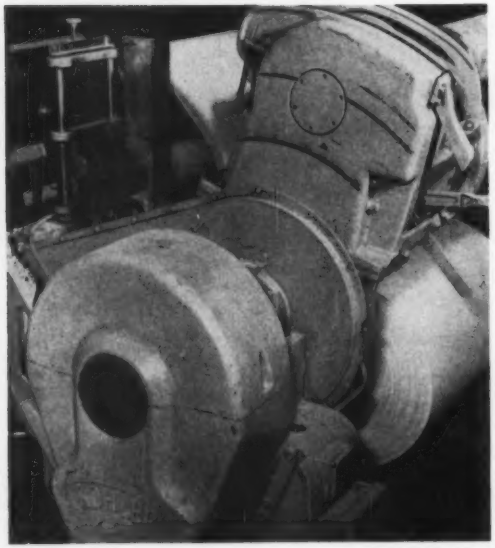

New Kohler System Plastic Winder

• Here it is, a new plastic winder—by Dilts—that may exactly meet your requirements.

One by one, check and consider the following operational features and time and money saving advantages:

1. Center winder.
2. Controlled tension.
3. Roll change at full web speed.
4. No waste on strike-in.
5. For film and sheeting.
6. Slitting for trim or narrow rolls continuous. Trim slitting uninterrupted.
7. Adjustable size roll slitting.
8. Controlled length of roll-metered.

With this new plastic winder you could (1) increase production, (2) decrease waste, (3) form better rolls, (4) save money.

Contact us. See it yourself.

Dilts Machine Works

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Associate: ALEXANDER FLECK LIMITED, Ottawa, Canada
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NO MORE WORRYING

about your high pressure reducing problems up to

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Simply specify the valve shown at the left — the

ATLAS Type "E"

High Pressure Reducing Valve

Even at 6,000 psi there is no shock whatever as has been learned by the many plastics plant operators all over the world who are now using this outstanding valve. Also, with equal ease, it handles air, water, or oil.

"What makes it TICK so well?" you ask. The answer to that is: More than a half century of experience in the making of regulating valves *exclusively*. Thus for instance the body of this valve is of the strongest forged steel. Internal metal parts are of hard chromium plated stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure. Want complete data?

For other ATLAS plastics plant products see the partial list in our ad in the January 1950 issue of MODERN PLASTICS

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Represented in Principal Cities

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PRODUCTION MOLDS

STRICKER-BRUNHUBER CORP.
Mechanical Developers
19 WEST 24th ST. NEW YORK 10, N. Y.

COURTESY U. S. AIR FORCE

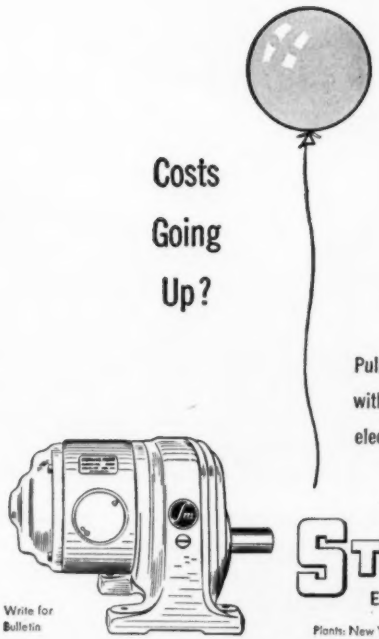
Resin treatment gives longer life to webbing of parachute harness

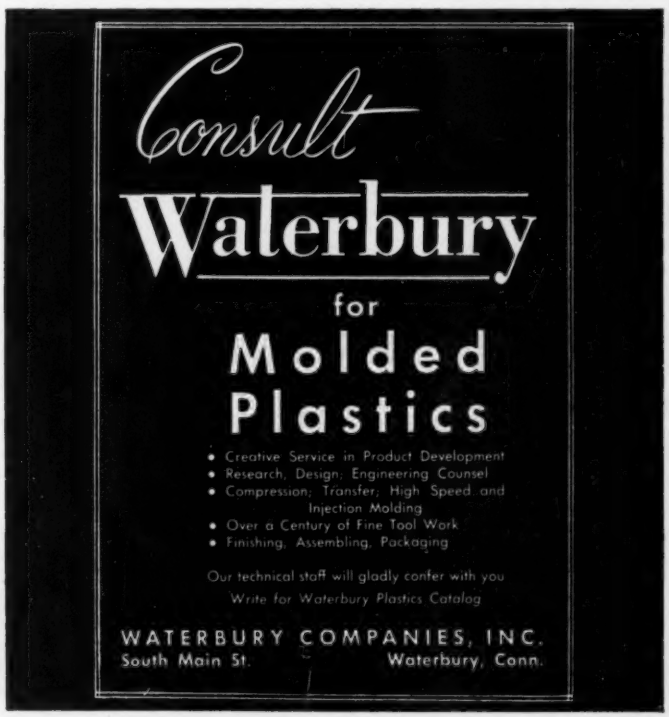
Parachute Harness

LONGER service life for parachute harnesses and greater safety in jumping operations are achieved by a process of treating the ribbon-like strands of the nylon webbing with a polyvinyl-butyral resin. The Materials Laboratory, Air Materiel Command, devised the process of pressing the resin into the webbing. The resin produced by Monsanto Chemical Co. and commercially known as Merlon-BR, does not penetrate the nylon fibers of the webbing but acts as an adhesive, keeping them from becoming separated and preventing fraying.

In processing the webbing strips, they are dipped into a tank containing a solution of water and a wetting agent, Duponal, in which is dispersed the Merlon-BR, and then run through rollers, similar to those on a washing machine, that press the resin in and remove the excess water. After oven-drying, the strips are ready to be stitched.

Tests of the treated webbing indicate that it outlasts the untreated type by three times, thus reducing demand for material and resulting in a saving to the United States Air Force of an estimated $1½ million per year. Weathering tests show that both the treated and untreated webbing withstand exposure to weather equally well.

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Our technical staff will gladly confer with you
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WATERBURY COMPANIES, INC.
South Main St. Waterbury, Conn.

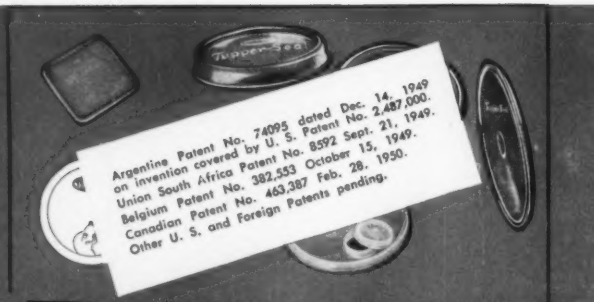
Tupper Seal, air and liquid tight flexible covers [illegible] and are included in the sets of all Tupperware Canisters.

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Bread Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing the cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.



Argentine Patent No. 74095 dated Dec. 14, 1949 on invention covered by U. S. Patent No. 2,487,000.
Union South Africa Patent No. 8592 Sept. 21, 1949.
Belgium Patent No. 382,553 October 15, 1949.
Canadian Patent No. 463,387 Feb. 28, 1950.
Other U. S. and Foreign Patents pending.

TUPPER! Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

TUPPER!

FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Pour Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.

The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

When equipped with Tupper Seal, air and liquid-tight, flexible covers Tupperware Cereal Bowls serve many another purpose.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 2 oz. Tumblers also fits and is sold with all Tupperware Funnels as a boon when funnels are used as storage containers.

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

ADDRESS: Farnumsville, Mass., and Orem, Texas New York Show Rooms 225 Fifth Ave.

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PHOTOS COURTESY TENNESSEE EASTMAN CORP.

Arm rests blend with chair upholstery, right. Bosses in underside, above, permit assembly

Chair Arm Rests

MOLDED butyrate arm rests for a modern office chair contribute largely to the pleasing appearance, relaxing comfort, and long-wearing qualities so widely demanded today in the furnishings of a well-appointed office.

Molded of Tenite II cellulose acetate butyrate by General Electric Co., Taunton, Mass., the arm rests convey a luxurious impression by their leatherlike surface finish. At the same time, the plastic's warm touch combines with the rounded shape which follows the contour of the chair arm to provide pleasing comfort for the user.

The butyrate rests require no oiling or preservative (as does leather), are tough and rigid, and will withstand hard use. Moreover, the color, because it is an integral part of the material, will not wear off. The Tenite arm rests are produced in several shades designed to harmonize with the various upholstery colors in which the chair is offered.

Tapped projections, molded on the underside of the plastic, fit through corresponding holes in the chair arm; assembly is accomplished with Phillips screws. The complete chair is manufactured by The General Fireproofing Co., Youngstown, Ohio.

WHY are we the outstanding mold makers for plastics?

BECAUSE we have been

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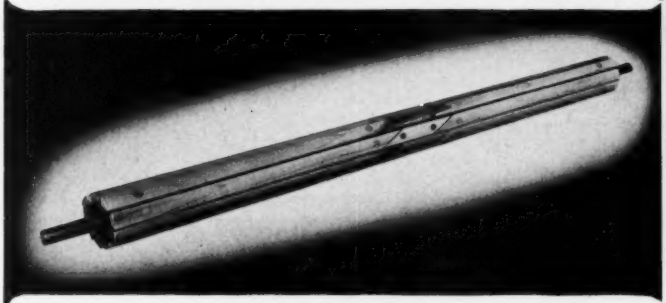
STOPS FILM FROM WRINKLING!



Install Progressive Anti-Wrinkle Slat Expanders at strategic spots along your film processing line and watch those wrinkles disappear! You'll find that your equipment (embossers, tubers, batchers and the like) run faster; that your rolled film is tighter and smoother and neater than ever before. You can get Progressive Slat Expanders in widths to fit your present converting equipment. Write today for complete details and prices.

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Vinyl formulations not meeting your usual high requirements? Here's how to keep from "tossing and turning" on into the morning! First, isolate your vinyl processing troubles. Check uniformity of the raw materials you are using. If this doesn't help and your batch is formulated for correct stabilization, the variable may be the stabilizer you are using.

Maximum activity and top-notch results are obtained *only* when stabilizers are selected with an eye to the processing of *specific* resins and plasticizers.

HERE'S HOW YOU BENEFIT

When you standardize on Ferro Stabilizers, you get more sleep. And—in addition, you set up for future vinyl processing a flexible, complete line of stabilizers of single metals as Barium, Cadmium, Lead, Strontium, Calcium or of Pure Organics or Phosphate. Often we recommend *combinations* of these stabilizers in ratios and concentrations to yield maximum utility in your *specific* formulation. Like more information? Write. Samples and data will be forwarded promptly.

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BEDFORD, OHIO

A COMPLETE LINE OF... VINYL STABILIZERS · METALLIC SOAPS · DISPERSING AGENTS · SURFACE ACTIVE AGENTS · DRIERS · COBALT COMPOUNDS

Tube Clip Insulation

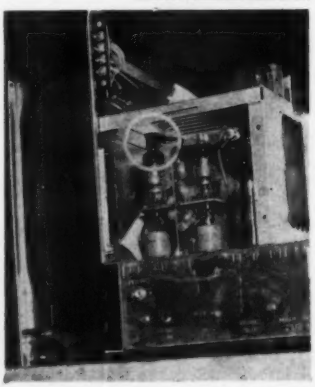
THROUGH the use of molded polyethylene, Alden Products Co., Brockton, Mass., is producing vacuum-tube cap connectors in which the insulation for the wire lead and the grid cap is a single homogenous unit. The result is continuous insulation—ideal for high-voltage applications—and complete strain relief on the wire lead.

Alden's latest additions to its standard tube-cap line, referred to as 90 ISL and 91 ISL, came about as the result of basic changes in television circuit designs requiring a unit of this type. Since large-volume and cost factors were involved, Alden replaced its former connector (with the clip and lead assembled separately) with the injection molded polyethylene design, permitting a saving in cost of 50% over the original model. In addition to this economy, the new connector offers top quality and the ability to meet the current rapid-delivery demands of the television industry.

The 90 ISL is designed to fit a standard all-metal tube top with a diameter of ¼ in., while its companion, the 91 ISL, will fit standard glass receiver-type tubes having a diameter of $^{23}/_{64}$ inch. Alden provides the lead in lengths tailored to customer specifications.

New type tube cap connector (circle) is continuously insulated

COURTESY STROMBERG-CARLSON CO.



Another good reason to specify

ERIE CUSTOM MOLDED PLASTICS

. . . Complete Facilities for Designing, Producing, and Maintaining Our Own Dies

ERIE RESISTOR

has the *know-how and facilities* to make better dies

Two views of our enlarged tool room and die department.

One of a series of advertisements describing Erie Resistor's complete facilities for quality custom molded plastics.

TO produce dies for quality molding, engineers must not only know die designing and making; they must know plastics and their properties . . . how they react under the temperature and pressure to which they are subjected in the molding process.

Our own trained engineers design the dies for all jobs to be injection molded in our own new 75,000 square foot factory. Our own engineers, in conjunction with our completely equipped tool room, maintain existing dies in top operating condition, as well as constructing new molds. Several of our tool makers have been with us since ERIE pioneered custom injection molding in 1935.

Many times these facilities have been the determining factor in the successful molding of difficult items and in building the enviable reputation ERIE RESISTOR has gained through the years.

Plastics Division

ERIE RESISTOR CORP., ERIE, PA.

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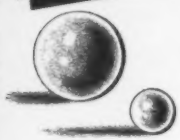
✓ ANY FABRICATION JOB
✓ any plastic material
see CRYSTAL PLASTICS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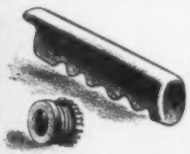
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for LAMINATING and MOLDING
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PHENOPREG MB—Melamine resin impregnated fabrics and papers for decorative laminates—resist abrasion, alkalies, solvents and will not stain from juices. Many colors and designs. Excellent electrical properties, density, surface gloss.

PHENOPREG RP—Decorative surfacing for plywood, veneer, other boards. Bonds directly to plywood without cushion sheets—Needs only 150 psi pressure. Produces high gloss with good abrasion resistance. Solid color grades and printed patterns.

PHENOPREG LP—BCM resin treated Fiberglas fabric. Supplied ready for lay-up assembly and curing without further processing. For plane parts which require high strength/light weight ratio, and for fabricating drill jigs, routing fixtures, etc. In flame resistant, corrosion resistant formulations.

PHENOPREG materials are resin impregnated papers, fabrics and Fiberglas for laminating and molding by application of heat and pressure. They offer untold possibilities for producing molded laminates, structural assemblies, laminates, reinforcements for molding compounds, core stocks and many other applications.

We invite your inquiries about standard and special grades of PHENOPREG materials. Ask for a sales engineer to assist with your technical problems.

FABRICON PRODUCTS, INC.
PLASTICS DIVISION

1721 Pleasant Avenue • River Rouge 18, Michigan • Vinewood 1-8200
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Toys Take Bumps

EVERY motor-happy kid will get a kick out of these automotive toys with bodies of bright cellulose acetate which feature friction-drive motors.

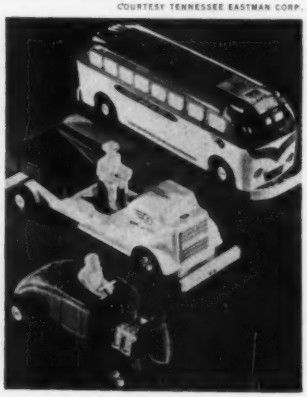
For the durability needed to withstand the "cross-country" hops and playtime abuse of these toys, Saunders Tool & Die Co., Aurora, Ill., molded them of Tenite I cellulose acetate. The material is virtually shatterproof in such use. The body of the Super Motor Bus, patterned after a luxurious trans-continental liner, is red, yellow, and silver decorated with decals. The Bump and Dump Truck is available in a choice of red body with yellow dump, or yellow body with red dump. The Hot Rod has a bright red body, and its stripped-down motor and grille are aluminum colored. Plastic colors are chip-proof.

Activated by a short, even push, the bus travels forward, reverses when it hits a wall or other solid object, and goes forward again when it hits another obstacle, continuing the cycle until the motive power dies. The motor of the bus is said to run three to four times longer than the ordinary friction motor.

The dump truck, after backing into a solid object, automatically dumps its contents and starts forward to the sender. A "souped-up" motor in the racing car provides the little racer with enough power to run, climb, and even jump.

Brightly colored toys are made of sturdy, high-strength acetate

COURTESY TENNESSEE EASTMAN CORP.



• MANUFACTURERS' LITERATURE •

To obtain any of the booklets or catalogs listed below, simply circle the corresponding number on the post card, fill in the information requested, and mail.

HOT STAMPING PRESSES. Literature giving complete details on the Kensol 35, both hand- and air-operated, and the Kensol Junior Model 7 hot stamping presses for plastics. Olsen Mark Corp. **(11-24)**

ELECTRIC RADIANT HEATERS. Application data sheet on Chromalox electric radiant heaters used to speed up the drying process and provide uniform drying of plastic powders. Illustrated. Edwin L. Wiegand Co. **(11-25)**

PLASTICS AND RUBBER PROCESSING MACHINERY. Illustrated and described are calenders, multiple deck presses, belt presses, mixing mills, vulcanizers or autoclaves, and a twin mill unit. Adamson United Co. **(11-26)**

TRACER-CONTROLLED MILLING. Detailed information, including specifications, on the Keller Type BG-22 tracer-controlled milling equipment. Four illustrated pages. Pratt & Whitney, Div. Niles-Bement-Pond Co. **(11-27)**

RUBBER AND PLASTICS MILLS. Describes mills for processing rubber and plastics; gives tables of sizes and capacities and parts lists; also illustrates and briefly describes other processing units. 40 pages. Farrel-Birmingham Co., Inc. **(11-28)**

MODERN HYDRAULIC PRESSES. Presented in this 20-page illustrated brochure are various modern hydraulic presses as produced by The French Oil Mill Machinery Co. **(11-29)**

LABORATORY PRESS. General applications, improved features, and accessories for general research are included on the Carver laboratory press. Prices and specifications included. 30 pages. Fred S. Carver, Inc. **(11-30)**

PROCESSING EQUIPMENT. Catalog giving detailed information on Day mixers and sifters for granulars, liquids, powders, and light pastes. 16 pages. Illustrated. The J. H. Day Co. **(11-31)**

RUBBER AND PLASTICS LABORATORY MILL. General description of the EEMCO streamline Laboratory Mill having a roll size of 6 by 12 inches. Four pages. Erie Engine & Mfg. Co. **(11-32)**

SERVICES

CUSTOM MOLDING. The custom molding services offered to the field by Imperial are discussed. Also included is a chart on the characteristics of compression molded plastics to aid in the selection of the proper plastic for a specific job. 12 pages. Imperial Molded Products Corp. **(11-33)**

EXTRUSION SERVICES. Eight-page brochure explaining the many forms of plastic extrusions. Photographs and sketches of components fabricated for a wide variety of industrial and consumer products. Anchor Plastics Co. **(11-34)**

DOW PLASTICS. Illustrated brochure on the general line of Dow plastics including molding powders and products which are molded and extruded from them, packaging and sheeting materials, and synthetic textiles. 16 pages. The Dow Chemical Co. **(11-35)**

MOLDING OF PLASTICS. A 16-page, pictorial presentation of the facilities available at General Industries for engineering, mold making, compression, transfer, and injection molding, and finishing of custom-molded plastics. The General Industries Co. **(11-36)**

MISCELLANEOUS

PLAXPAK BOTTLES. Brochure illustrating and describing the various types of Plaxpak unbreakable polyethylene bottles. Four pages. Plax Corp. **(11-37)**

EXTRUSION OF POLYETHYLENE FILM. Four-page reprint presenting information on the technique of producing polyethylene film by sheet extrusion and by inflated tube extrusion. Modern Plastic Machinery Corp. **(11-38)**

COUNTING BY WEIGHT. Catalog of Toledo scales containing a complete section of information dealing with the various ways in which scales may be used. 24 pages. Toledo Scale Co. **(11-39)**

TUMBLING METAL AND PLASTIC PARTS. Details on Lupomatic processes and compounds for polishing, cleaning, and definning metal and plastic parts, and the compounds and carriers which should be used for each operation. Lupomatic Industries, Inc. **(11-40)**

MOTION PICTURE CAMERA FOR MOTION STUDY. Uses of Wollensak Fastex motion picture cameras in slowing down high speed motion for analysis and study. Numerous applications are suggested. 12 page brochure. Wollensak Optical Co. **(11-41)**

INDUSTRIAL THERMOCOUPLES. Catalog section illustrating industrial thermocouples for all pyrometers. Explains how to select the exact model for a specific use. Eight pages. Thermo Electric Co., Inc. **(11-42)**

HYDRAULIC CYLINDERS. Complete dimensional and engineering data on various types of hydraulic cylinders including single acting and double acting models. Eight pages. Miller Motor Co. **(11-43)**

TIRES AND WHEELS FOR BANDSAWS. Data folder on Carter quick-change demountable tires and rigid wheels for bandsawing of woods, metals, and plastics. Carter Products Co. **(11-44)**

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TEFLON TAPE FOR ELECTRIC INSULATION. Properties and suggested uses of Teflon as a high-quality electrical wrapping tape for insulation in motors, generators, and conductors. Eight pages. E. I. du Pont de Nemours & Co., Inc. (11-1)

CHEMICALS FOR PLASTICS. A catalog of general chemical products, many of which are used in the plastics industry. Includes physical properties, specifications, formulas, and uses. 64 pages, plastic bound. Tennessee Products & Chemical Corp. (11-2)

STAFLEX KA. Description of a plasticizer which is designed to incorporate some of the advantages of the high-molecular-weight polymerics without their disadvantages. Five sheets. Deecy Products Co. (11-3)

PACKAGING WITH BAKELITE AND VINYLITE PLASTICS. Illustrated eight-page brochure discussing the outstanding packaging applications of Bakelite and Vinylite plastics. Bakelite Div., Union Carbide and Carbon Corp. (11-4)

PLIOLITE FOR REINFORCING RUBBER. Included are the properties, compounding procedure, applications, etc., of Pliolite S-6. 60 illustrated pages. The Goodyear Tire and Rubber Co., Inc. (11-5)

LAMINATING MATERIAL. Technical data sheet and brochure providing detailed information on Dryply low pressure laminating material. Flexfirm Products. (11-6)

WAXES WITH POLYISOBUTYLENE CONCENTRATES. Four-page technical data sheet on uses of improved Arwaxes with paraffine and microcrystalline waxes for coating papers and plastic films, for heat seal coatings, and for laminating. American Resinous Chemicals Corp. (11-7)

FORMALDEHYDE. Given is information on the specifications, physical properties, methods of analysis, general precautions, storage and handling, and uses of formaldehyde. 30 pages. Celanese Corp. of America. (11-8)

INORGANIC PIGMENTS. Bulletin giving some of the outstanding properties of Drakenfeld inorganic pigments when used in plastics and how to incorporate them into the resin. B. F. Drakenfeld & Co., Inc. (11-9)

CASTING RESIN. A technical discussion of a liquid phenolic casting resin—its physical properties, various applications (illustrated) and full instructions for its use. 12 pages. Durez Plastics & Chemicals, Inc. (11-10)

PROPERTIES OF KODAPAK SHEET. A 24-page booklet describing the various formulations of Kodapak and giving a complete technical description together with a detailed summary of performance tests. Eastman Kodak Co. (11-11)

PLASTOLEIN PRODUCTS. Contains properties and characteristics of all Emery plasticizers, special fatty acids for alkyds and the new Emery M-461-R, Dimer Acid, and its application in the surface coating field. 16 pages. Emery Industries, Inc. (11-12)

VELON. Gives general information about the uses of Velon film, filament, sheeting, and garden hose. Three sheets. Firestone Plastics Co. (11-13)

MOLDING POWDERS. General properties and uses of Gering's polystyrene, cellulose acetate, vinyl, ethyl cellulose, and polyethylene film are given in this descriptive folder. Four pages. Gering Products, Inc. (11-14)

HYCAR LATICES. Technical bulletin on Hycar Latices including data on properties, compounding, protective coatings and finishes, pigment binding, dipping. Photographs, tables and recommended formulations are included. 20 pages. B. F. Goodrich Chemical Co. (11-15)

POLYSTYRENE. General information on Koppers polystyrenes is given. Illustrations are included. Four pages. Koppers Co., Inc. (11-16)

ALKYD MOLDING MATERIAL. Bulletin giving the electrical properties, technical services, mechanical properties, chemical properties, molding characteristics, etc. of Plaskon Alkyd molding material. Four pages. Plaskon Div., Libbey-Owens-Ford Glass Co. (11-17)

ADHESIVES

UFORMITE JS-508. Properties and methods of use for a one-component, urea formaldehyde resin adhesive for the tapeless splicing of plywood veneers. Four sheets. Rohm and Haas Co. (11-18)

ACETATE CEMENT. Technical data sheet discussing a water-white solvent combination formulated specifically to replace acetone in the bonding of cellulose acetate to cellulose acetate. Schwartz Chemical Co., Inc. (11-19)

UREA RESIN. A four-page folder describing the advantages of using Lauxite UF-89 fast-setting urea formaldehyde resin for hot pressing. Monsanto Chemical Co. (11-20)

RESIN BINDER. Cycor 191, a liquid synthetic resin binder for sand cores and dry molds, is presented with its advantages, storage life, suggested formulations, mixing procedures, baking procedures, etc. Price schedule is included. Six pages. American Cyanamid Co. (11-21)

PRODUCTION EQUIPMENT

HYDRAULIC PRESSES. Specifications, features, and applications are given in this 12-page booklet about hydraulic presses produced by The Baldwin Locomotive Works. (11-22)

INJECTION MOLDING MACHINES. Reprint of an article discussing the progress and development of R. H. Windsor Ltd., including details on the injection molding equipment produced by this company. 16 pages. R. H. Windsor Ltd. (11-23)

MANUFACTURERS' LITERATURE DEPARTMENT
MODERN PLASTICS

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Added Beauty

(*Continued from pp. 71-76*)

with the exception of polyethylene, acetate, and butyrate. The second type, which Meyercord calls the Type B transfer, is intended for use on acetate and butyrate.

A special decal for use on cellulose acetate has also been developed by Midwest Decalcomania Co., Chicago, Ill. They are used, for example, on a line of toy trucks molded of Tenite I by The Conway Co., Skokie, Ill. The decals are used to make the products of the same mold into Carnation Milk trucks, Kraft cheese trucks, Curtiss candy trucks, or Railway Express trucks. (See photograph of this multiple use of decals on page 76.)

Metallizing—An important method of decorating molded items which should not be ignored is metallizing. Of the three methods of metallizing plastics (electroplating, silver reduction, and vacuum metallization), the vacuum method is generally considered the most economical. That method was recently analyzed in two different articles.[6]

Silk screening—For laying down fairly simple designs on plane or almost plane surfaces, silk screening is often the preferred method. No large investment or elaborate equipment is needed and the process is simple. A number of companies interested in silk screening have formed The Screen Printing Association[7] to promote the use of the process. Detailed information in regard to equipment, inks, stencils, etc., is available from that group.

Marking methods—In addition to the methods of decoration already mentioned, there are, of course, methods of marking plastics which are used for identifying or labeling rather than for decorating or adorning them. Included are hot stamping, branding, wipe on, engraving, etc. These methods have been discussed in detail elsewhere[8], and space limitations prevent their inclusion in this article.

[6] "Metallizing by High Vacuum," by Marvin Schneider, MODERN PLASTICS 27, 137 (Apr. 1950). See also "Metallizing" in the "1950 Modern Plastics Encyclopedia and Engineer's Handbook," p. 372.

[7] Located at 332 So. Michigan Ave., Chicago 4, Ill.

[8] See the article "Stamping, Printing, and Engraving," in the "1950 Modern Plastics Encyclopedia and Engineer's Handbook," p. 362.

As the foregoing survey indicates, the decoration methods already developed in some fields are fully satisfactory. Examples include doll heads and three-dimensional plaques for refrigerators, automobile horn buttons, etc.

In other fields, the decorating problems have yet to be solved. When they are solved, as they undoubtedly will be in the near future, plastics will be able to compete more successfully with other materials in those fields. For example, there is as yet no fully satisfactory method for decorating melamine tableware, and it is sold only in solid colors. Similarly, there is no proved method for decorating small plastic toys so that they can compete with lithographed sheet metal in appearance, durability, and economy.

But perfecting new decorative techniques is only one of the ways in which the art of decorating molded plastics can be expected to progress. With a little ingenuity and imagination, the methods already available can be applied to improve and/or beautify many molded products.—END

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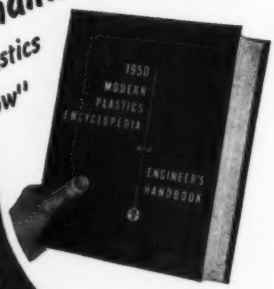

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Styrene's March

(*Continued from pp.* 78-81)

improper flow-type polystyrene or improper molding conditions are used. In 1946 there was no standard polystyrene that could be used for moldings of this size. Today, because of improved polymerization technique, lubrication, elimination of trapped air in the granules, and various other factors, a 34-oz. crisper can be molded. Two years ago, a 12-oz. dish was big! Now a television lens weighing 59 oz. can be molded. Four years ago there was no suitable polystyrene from which these screens could have been molded—better flow, a higher heat distortion, and proper lubricants have made them possible. Radio cabinets with a draw of about 8 in. and containing 3 lb. of molding material can be molded today. A 1½-lb. transparent hair dryer for beauty shops has replaced metal and is not only lighter but gives milady a chance to see what's going on. Furniture components may be next on the list of large pieces. Only a few far-seeing technicians believed these things could ever be done with polystyrene when it was a baby.

But it's not only the big pieces that enjoy the benefit of improved polystyrenes. Alongside a large 10-lb. half of an aircraft battery case can be placed a tiny 3- or 4-oz. hearing aid, camera finder lenses, and extremely complex pieces with difficult and thin undercuts which were considered impossible two or three years ago. Rulers that were laughed at when first produced a few years ago because of possible shrinkage and distortion are now accepted.

Bubbles Eliminated

Brush backs are another example. The early ones were terrible. Bubbles formed in the thick sections because of the problems experienced in getting a lot of material to pile up on itself. With the advent of improved lubrication the molding temperature could be reduced—the flow was easier—and a solid homogenous article was produced. There still remains to be solved more satisfactorily the problem of stapling the bristles into the brush back without crazing, but progress is being made.

A typical example of triumph in achievement that unites nearly all the factors mentioned in polystyrene molding material advancement is a new milking machine head weighing 8 oz., molded in one piece, that reduced the number of parts in the original item from 20 to one. This one molding replaced four brass castings, two wire hangers, two pieces of glass, six pieces of rubber, two screws, two washers, one nut and bolt.

All the above pertains largely to standard polystyrene molding granules produced for injection molding. Much more could be related if space were available. But of this we can be certain—if improvements in molding material alone continue in the next ten years at anywhere near the rate they have in the last four, styrene is on the way to becoming a far greater influence in American industry than anyone ever dreamed it would become when it was brought to this country in the early 1930's.—END

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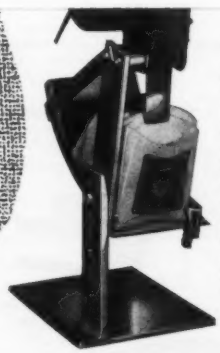

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(Continued fr

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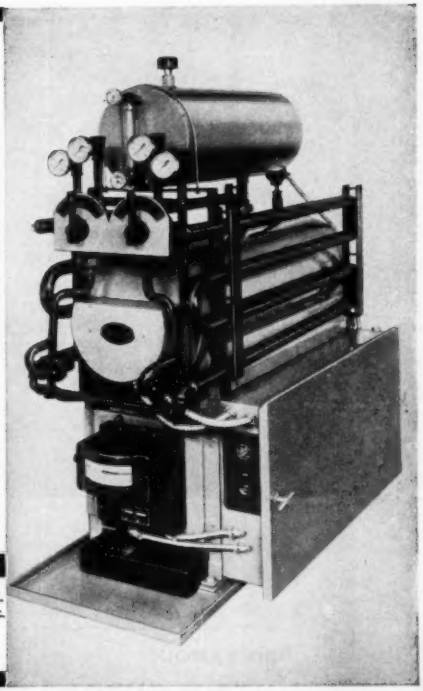

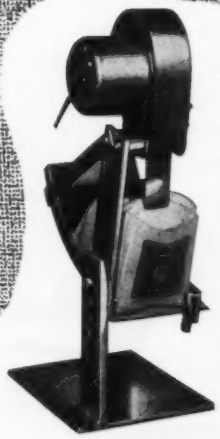

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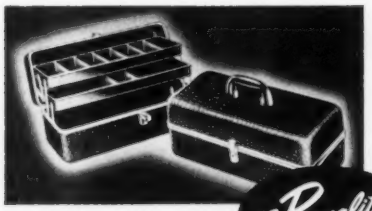

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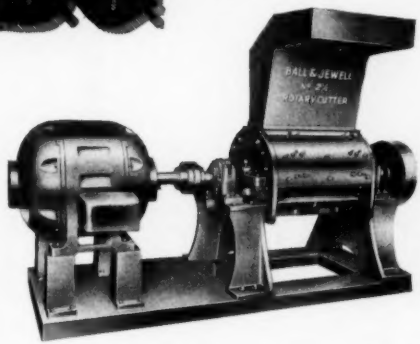

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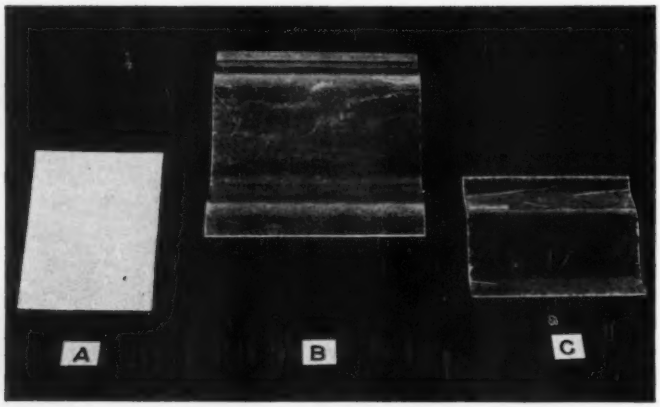


3—Commercially available glass-fiber reinforced sheets prepared for radiographic test. Approximate thickness in inches: A, 0.075; B, 0.070; C, 0.065

Filled Plastics

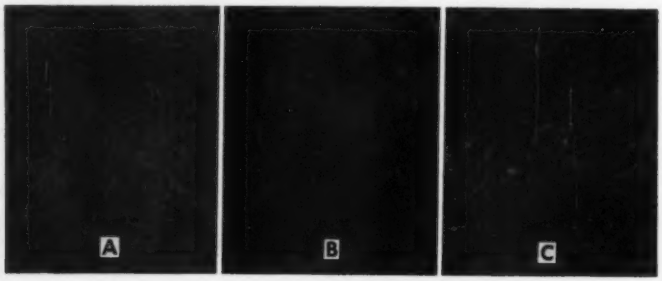
(*Continued from p.* 123)

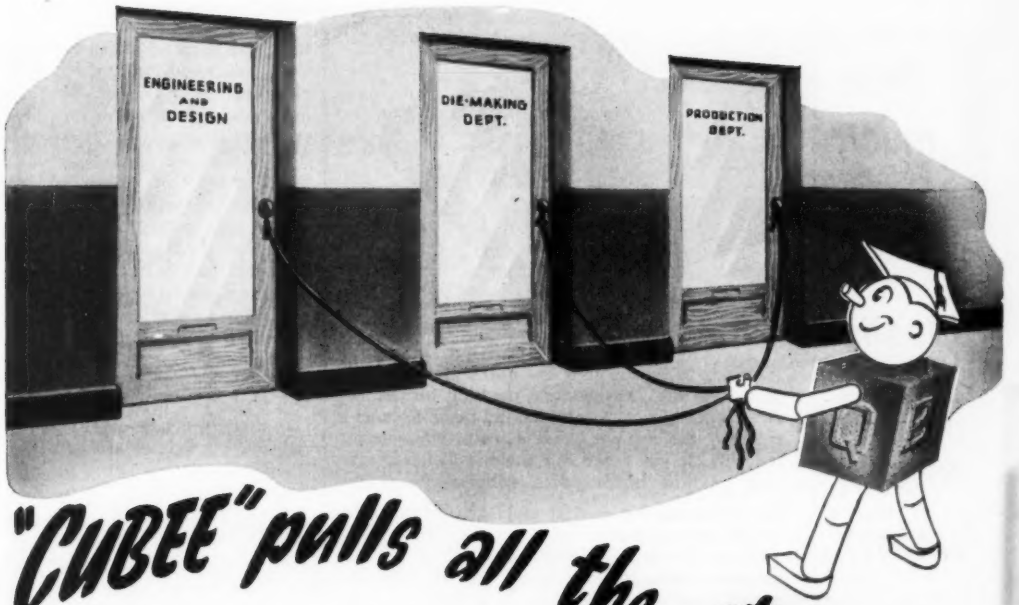
therein were cast from polyester resin (Paraplex P-43) and contain known amounts of glass fiber as a reinforcing agent. Disks A and B contain 25% glass fiber by weight and disk C contains 20% glass fiber. In the case of disks A and C a uniform distribution of the glass fiber was sought, while in the case of disk B, distribution control of glass fiber was not attempted, and an uneven distribution resulted.

A visual examination of the three disks indicated no apparent difference between disks A and C. Both appeared to have approximately the same glass fiber content and no non-uniformities were observable. In the case of disk B, some non-uniformity was apparent visually, but its serious nature was not recognizable. However, radiographic examination clearly demonstrated the individual characteristics of all three disks. Figure 2 is a reproduction of a radiograph of the three disks and was made under the following conditions: 30 KV.; 5 ma.; 10 min.; A film (Eastman); 36 in. f.d.; no screens or filters. Visual examination of the radiograph clearly indicated the non-homogeneous character of disk B, and the higher fiber content of A as compared to C.

Measurements on a densitometer (Ansco-Sweet Densitometer, American Standard Diffuse Density) gave even more clear-cut proof of the value of this method. Each of the three individual radiographs was subjected to densitometer readings at 10 different points, selected at random. Results are shown in Table I. The smaller standard deviations and narrower ranges observed in the cases of disks A and C, as com-

4—Radiographs of three materials in Fig. 3. Conditions of test were: 30 KV.; 5 ma.; 10 min.; A film (Eastman); 36 in. f.d.; no screens or filters





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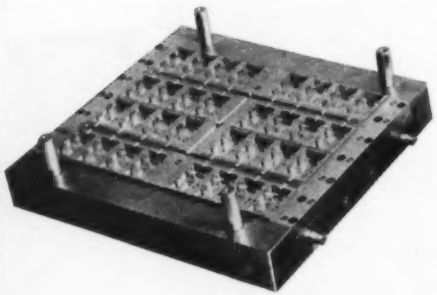

It stands to reason that the *more* pieces a mold produces, the *less* it costs per unit turned out. Also, when rejects are fewer and finishing time is reduced, the cost per piece is lower. The question is, "How do you make sure molds will run longer, and produce better parts, with less trouble?"

Here's where the custom molder and the moldmaker enter the picture. When you have plastic mold work done outside your plant, their skill and genuine desire to do a good job are your best guarantees of a dollar's worth of mold for each dollar spent. Sure, molds can be had for a few pennies less. But over the long haul "bargain" molds are going to cost *more*—in dollars, cents, and headaches.

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pared to disk B, clearly indicate the more homogeneous nature of these two items, resulting from the more uniform dispersion of the glass fiber. Also, comparison of the mean visual densities of the three samples readily reveals the fact that disk C has an appreciably lower fiber content than disks A and B. Further, while direct visual examination of the specimens furnished practically no information, and visual examination of the radiographs afforded a method of making a relative evaluation, the procedure indicated above enables the operator to set definite quantitative limits on the permissible variation in the case of a given product.

In practice it is first necessary to radiograph a number of experimental pieces under standardized conditions, analyze the radiographs, and then subject the pieces to destructive testing to establish allowable limits in mean visual density, density range, and standard deviation. Thence-forward, pieces from the same mold and composed of the same materials may be radiographed under the same conditions to establish whether or not sufficient inorganic pigment, filler, or fiber is present, and in the correct distribution. Quite obviously, any change in the design of the piece, or a change in the nature, quantity, or form of the filler will necessitate the establishment of new control limits.

This method of non-destructively assuring the correct percentage and distribution of inorganic pigments, fillers, or fibers in organic plastic structures is of particular value when the thickness of the item, high filler content, or colors make direct visual examination or direct light transmission measurements of little or no value. Nevertheless, it is of assistance even in those cases of thin, reinforced plastic sheets which have an appreciably high transmission in the visual range, since small amounts of dye which have no structural significance may have an appreciable effect on direct light transmission without in any way affecting radiographic results. Thus, using the radiographic technique, parts or sheets fabricated in several colors, otherwise identical, would be checked against a single set of standards provided such col-

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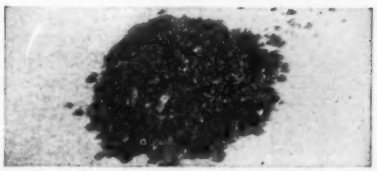

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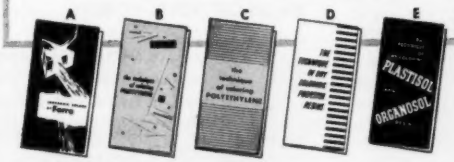

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oring was affected solely by organic chemicals.

Examples of commercially available materials examined by this method are illustrated in Fig. 3 and 4. Figure 3 is a photograph of three glass-fiber reinforced plastic sheets as follows:

3A. Polystyrene-impregnated 2-oz. glass mat having a resin content of approximately 70%. Approximately 0.075 in. thick.

3B. Fiberglas-reinforced polyester corrugated sheet made by Texas firm. Approximately 0.070 in thick.

3C. Fiberglas-reinforced polyester corrugated sheet made by California firm. Approximately 0.065 in. thick.

Figures 4A, 4B, and 4C are reproductions of radiographs of the three materials cited in the preceding paragraph. These radiographs were prepared under the same conditions as noted in the case of Fig. 2. A large number of density readings were made on these three radiographs; results are in Table II.

Table II.—Densitometer Measurements on Radiographs of Commercial Moldings.[a]

Molding	$\bar{X}$	σ	*R*
4A	1.44	0.029	0.10
4B	0.67	0.025	0.10
4C	0.71	0.013	0.05

[a] Code for abbreviations:
$\bar{X}$ = arithmetic mean (average); σ = standard deviation; R = range (difference between maximum and minimum).

While the values in Table II are not necessarily typical of the products mentioned, the narrow ranges and the standard deviations observed in this case indicate that the specimens examined were extremely uniform and, in a measure, may be considered to indicate the greater uniformity that may be attained in production runs as compared to laboratory samples.

In conclusion, it should be stressed that not only does radiographic testing supply a rapid and accurate method of determining the quantity and distribution of inorganic pigments, fillers, and fibers in organic plastics, but also its non-destructive nature makes more extensive testing of manufactured articles feasible and, therefore, makes possible a higher and more uniform quality in the product.

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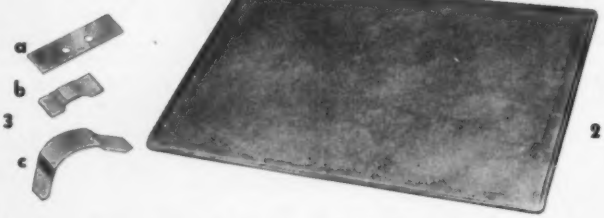

Above illustrations are examples where fiberglas-reinforced plastic solved problems.

1. Beverage cooler lid and panel. Dry Coolers require a deep lid to hold insulation plus exceptional contour to fit into the rubber gaskets and seal in the dry cold. Fiberglas-reinforced plastic solved the problem.

2. Poultry dropping pan of fiberglas-reinforced plastic eliminated corrosion and denting, simplined cleaning, and lasted several times longer.

3. Fiberglas-reinforced plastic is proving superior for refrigerator applications. (a) Strike connector made from flat sheet has two self-tapping holes and two counter-sunk holes.

(b) Strike plate of fiberglas-reinforced plastic eliminates transfer of heat from food liner to outer shell and cuts out previous assembly requiring three separate pieces and four rivets. Center is built up to .340" and the ears to .187". Serrations ground into top surface mount the strike.

(c) Shell gussets give structural strength needed between the food liner and outer frame of refrigerator yet are not conductors of heat. Need for less insulation allows larger food liner with the same size outer shell.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946, of MODERN PLASTICS, published monthly at Orange, Connecticut, for November 1, 1950.

State of New York }
County of Bronx } ss.

Before me, Notary Public in and for the State and county aforesaid, personally appeared Charles A. Breskin, who, having been duly sworn according to law, deposes and says that he is the Publisher of the MODERN PLASTICS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, Chas. A. Breskin, 122 E. 42nd St., New York City.

Editor, Hiram McCann, 122 E. 42nd St., New York City.

Managing editor, A. Paul Peck, 122 E. 42nd St., New York City.

General manager, A. S. Cole, 122 E. 42nd St., New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Modern Plastics, Inc., 122 E. 42nd St., New York City.

Chas. A. Breskin, 122 E. 42nd St., New York City.

Mrs. C. A. Breskin, 55 Park Road, Scarsdale, N. Y.

Linda S. Breskin, 55 Park Road, Scarsdale, N. Y.

Theodore B. Breskin, 540 Tuckahoe Ave., Yonkers, N. Y.

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E. S. Gregg, 111—8th Ave., New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding one percent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

CHARLES A. BRESKIN, Publisher

Sworn to and subscribed before me this 20th day of September 1950.

[SEAL] HERMAN L. ISLER

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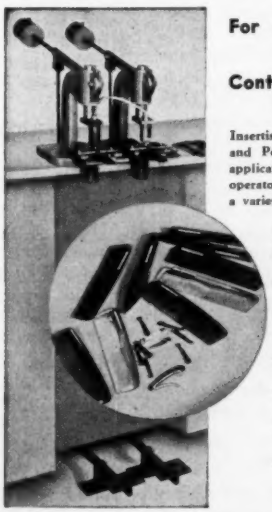

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Plastisol Wall Covering

PLASTISOL coated over a cotton backing forms a new wall covering which has been developed by Susquehanna Plastics Div., Susquehanna Mills, New York, N. Y. The material, called Suskana Wall Fabric, is furnished in 36-in. width.

Like other vinyl surfaces, the surface of Suskana is impervious to ink, grease, water, and most chemicals; is fire resistant, colorfast, and odorless; and the producer claims that it will last longer than the linseed-oil coated fabrics which have been used for this type of wall covering for many years. The covering is especially suited to bathrooms, kitchens, dinettes, and play rooms, but designs are being developed to suit any room of a house.

The material may be easily applied by the home owner with ordinary wallpaper paste. The edges are trimmed so that there is no overlap and no trouble in matching the design. If it is ever necessary to remove the wall covering or if the home owner decides to change the decorative scheme, it is a simple matter to pull this covering from the wall without the usual mess encountered when ordinary wall coverings are removed. The covering will not crack, chip, nor peel, and when the housewife wants to clean it, she can scrub at particularly stubborn spots without danger of rubbing off part of the design.

A roll of the material contains 36 sq. ft., or 4 linear yd. of 36-in. material. It retails at $2.85 a roll for printed design and $2.45 for tints, which compares to the medium bracket for paper wall covering.

Vinyl Wraps

TWO-year toxicity tests and studies of the extraction resistance of Flexol plasticizer DOP-20 in vinyl food wrap films indicate that the material has been found suitable for use in vinyl plastics which come in contact with many foods, it is reported by Carbide and Carbon Chemicals Div., Union Carbide and Carbon Corp. Flexol DOP-20 is especially recommended for film wraps for prepackaged meat, vegetables, and frozen foods; water and ice bags; milk and beer tubing; intravenous tubing; cap liner stock coatings; and adhesives for food packages.

Thermosetting Laminate

DEVELOPMENT of a new thermosetting laminate called CEE Grade Lamicoid has been announced by Mica Insulator Co., Schenectady 1, N. Y. The new laminate is suited for use in oil-filled transformers, terminal boards, and switchplates for regulators. It is a Class A insulation, designed to withstand a "hottest spot" temperature of 221° F. It is claimed that it will not blister or delaminate in hot oil, and a heavy fabric base gives it sufficient strength and toughness to provide good mechanical support for conducting elements.

Industrial Preparedness

THE new general manager of the Plastics Div., Monsanto Chemical Co., Springfield, Mass., is F. A. Abbiati, succeeding Mr. Felix N. Williams, who goes to St. Louis to take over the position of coordinator of sales for the company. Mr. Williams succeeds Francis J. Curtis who was recently named by Monsanto as its director of industrial preparedness and who will devote his full time to this new department with headquarters in Washington, D. C. Mr. Abbiati, a native of Barre, Vt., joined the Merrimac Div. of Monsanto as a salesman in 1927 and was transferred to plastic sales in 1938. Mr. Williams joined the company in Anniston, Ala., in 1923. Mr. Curtis has been with Monsanto since 1915 and became vice president of the company in 1943 when he was also made secretary of the executive committee.

Monsanto has announced an expansion program in Texas City, Texas, which will involve a $30 million project, according to William M. Rand, Monsanto president. The new program involves chiefly the production of acrylonitrile and related chemicals from acetylene by a direct process.

Organic Acid

EVANACID 3 CS, a new organic acid, is being produced in pilot plant quantities by Evans Chemetics, Inc., 250 E. 43rd St., New York 17, N. Y. The new acid is a tricarboxylic acid containing a thioether group.

Special resins of the alkyd type are made by reacting 3 CS with polyhydric alcohol. The trialkyl esters of Evanacid 3 CS are plasticizers for vinyl. Other suggested uses are as an intermediate for rubber chemicals and dyestuffs, and as a stabilizer for vinyl resins and chlorinated rubber.

Visitors From Sweden

REPRESENTATIVES of the Swedish plastics industry are currently touring the United States for the purpose of studying the American plastics industry to help the development of exports of plastics raw materials and semi-finished products from their country. The tour is sponsored by the Economic Cooperation Administration.

The Swedish plastics industry represents a total business volume of around $40 million, not including the paint, varnish, and lacquer industries. It enjoys about the same volume as the Swedish rubber industry, according to a spokesman for the group. There are now almost 300 companies in Sweden manufacturing various plastics materials and finished products, in comparison to less than 40 companies in 1949, according to Jan-Erik Janson, executive secretary of the Swedish Plastics Federation.

The raw materials manufactured in Sweden are as follows: phenolic molding powders manufactured by four firms, annual capacity about 3500 tons; urea and melamine molding powders, adhesives, and lamin-

* Reg. U. S. Pat. Office.

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The dimensional stability, good electricals, chemical resistance, and aging properties of the polyester Vibrins® *can now be utilized* in conjunction with even highly porous materials such as wood, cloth, sisal mats, etc., by a *new* film transfer method described below.

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Luperco ATC	3-6 parts

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Coat a sheet of P. T. Cellophane with a 10% solution of Promoter #2 in toluol or other suitable solvent either by spray or wipe. Allow a few moments for the solvent to evaporate, then spray or knife coat a 1 to 5 mil film of Vibrin 112 plus catalyst (as in 1 above) onto the coated cellophane. Allow 3 to 5 minutes for setting and then proceed to the next step.

❸ FILM TRANSFER PROCEDURE

Place the surface of the wood, cloth, sisal mat or other porous material in contact with the resin coat on the cellophane and cure between 250° F. platens for 3-5 minutes. The pressure used will of necessity vary with the type of porous material being coated and will best be found by trial. After curing, the cellophane will strip from the resin and leave a glossy coat of Vibrin permanently in place on the material.

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PLASTISCOPE

ating resins produced by two manufacturers, with capacity sufficient to supply the Swedish market; and polyvinyl chloride made by one producer in quantities large enough to supply the major part of the Swedish market. There are six companies with calenders providing vinyl sheeting and eight or ten which coat fabric or paper with vinyl; two firms are reported ready to start commercial production of acrylics.

No cellulose acetate or ethyl cellulose is manufactured in Sweden at present, but two companies compound molding powders of these types from imported flake. One company now produces cellulose acetate film, and two other companies will soon start production by the extrusion method; a plant for polymerizing styrene monomer is under construction.

There are about 900 compression presses in Sweden with a total capacity of approximately 80,000 tons. There are between 175 and 200 injection molding machines ranging in size from ½ oz. to 32 ounces. There are only a few extrusion machines operating in the country.

Ethyl Isocyanate

ETHYL isocyanate is now available in addition to tolylene diisocyanate and other isocyanates from Monsanto Chemical Co.'s recently enlarged facilities at its Anniston, Ala., plant for the production of these products. The isocyanates, developed industrially by the Germans during the last war, are now used in the adhesives, paint, rubber, plastics, and textile industries.

Army Helmet Liners

AMONG the scores of plastic items which the Quartermaster is shortly expected to purchase in rather large quantities is a new helmet assembly consisting of an aluminum shell and a shock-resistant plastic liner to replace the present steel helmet and former plastic liner for special troops. The exact material used is classified information; therefore nothing is revealed concerning the type of plastics used. The Quartermaster has been developing this helmet ever since the end of World War II, and experimental contracts have been worked on. The new aluminum shell and liner combined weigh approximately 3 lb., or 15% lighter than the present steel helmet. The new molded liner, weighing 30 oz., is resilient, tougher, and possesses bullet-resistant qualities equal to or better than the steel used in the present helmets.

Processing Equipment

CREATED to design, develop, and distribute processing equipment for the rubber and plastics industries, a new company has been set up jointly by Aetna-Standard Engineering Co., Youngstown, Ohio, and Hale and Kullgren, Inc., Akron 8, Ohio. Aetna-Standard announces that Hale and Kullgren will act as its sole representative. Andrew Hale was former vice president in charge of sales and engineering in Adamson United Co. in Akron; G. V. Kullgren was in charge of contract engineering for Adamson and is well known in connection with the design of calenders and accessory equipment.

Messrs. Hale and Kullgren say they do not intend to engage in the handling of existing types of machinery such as mills, calenders, and so forth, but hope to serve the industry with new types of equipment.

Imports for Plastics

THE importation of benzol for June totaled 1,364,774 gal., of which 1,227,157 gal. came from the United Kingdom and the balance from Canada. This is considerably below the more than 3 million gal. reported in May; but, as noted in this column last month, 2 million gal. of the May imports came from Poland, and a duplication of that importation is not likely.

Naphthalene imports in June were 9,300,000 lb. in comparison to 12,800,000 in May. More than 6,500,000 lb. came from Germany. More than 1 million lb. came in during June from Czechoslovakia and Poland. Whether or not further importation can be expected from these countries is a question. Perhaps it is worth noting, in view of all the fuss about shipping our own products behind the Iron Curtain and in view of the refusal of stevedores to unload chemicals from Czechoslovakia, that the chemical industry can well use these important items for the improvement of defense whenever and from wherever they are obtainable.

Pulverizing Technique

RAPID, effective pulverization of previously hard-to-grind materials such as plastics, food stuffs, and other organic materials, is claimed for a method developed by The Linde Air Products Co., a unit of Union Carbide and Carbon Corp. Liquid nitrogen cools the material rapidly to a point of maximum fragility, reducing the amount of energy required for its fracture. Saran and styrene, previously resistant to speedy pulverization, are being successfully production-ground by this method.

Controls Slow to Start

NO ONE as yet knows the magnitude of the job ahead of the chemicals industry under the new National Production for Defense Act nor how long the job will take. According to Secretary of Commerce Sawyer and other Washington opinions there will be no turning back from the planned Defense Program even though the Korean situation comes well in hand.

Plans are now being made for setting up an agency to handle the ramifications of inventory control, priorities, allocations, possible construction of new plants for needed chemicals, etc. Benzol and chlorine are the two chemicals essential to plastics so far named to come under the inventory control program. Polyethylene was omitted from the first list, despite an admittedly short supply, which indicates a tendency on the part of the government to go slow with control orders if there is an indication that the industry itself can handle the problem. In the case of polyethylene, the problem is one of allocation of what remains of the supply after the government has obtained its required poundage. There is no certainty as to how this polyethylene situation will be resolved in the end; but

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Capacity of mill: 2 to 3 pounds
Space required: 28" wide, 60" long.

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at least until government demands become larger, it may be that the government will adopt a "hands off" policy on any polyethylene remaining after the Armed Forces obtain their priorities.

Government orders for polyethylene are still only partially made up and are not likely to reach full realization for the balance of this year or the first quarter of 1951. The second quarter of next year is expected to be the real "squeeze" period for polyethylene, with some relief in the third quarter when new production is scheduled to come in. No one can tell just how heavy will be the demand by Armed Forces. It is still possible that the military will want all the material there is—even of the new production—but, on the other hand, there are certain civilian applications which may prove of more importance to the overall economic welfare of the nation than some of the military uses. Polyethylene may be made available for such purposes in small quantities, but whether the raw material producers or the government will determine who gets this material is still unknown.

Marking Inks for Plastics

SELF-filling brush marking pens and quick-drying stamp pad inks that can be applied to polyethylene as well as other plastics have been announced by Time-Saving Specialties, 701 New York Life Building, Minneapolis 2, Minn.

Benzol from Petroleum

IN relation to the current shortage of benzol and what can be done about it, Dr. Robert S. Aries of R. S. Aries & Associates, calls attention to the Catarole process which he says has been thoroughly proved as a workable and practical operation by Petrochemicals, Ltd., of Manchester, England. Dr. Aries suggests that this method for obtaining benzol from petroleum might be quickly applied in this country.

The Catarole process is one of the developments of Dr. Chaim Weizman. Yields of over 10% of aromatics—benzol, toluol, xylol, and naphthalene—have been obtained, concurrently with aliphatic olefins such as ethylene. Thus the process has the advantage of simultaneously producing the raw material for styrene which is made from a combination of ethylene and benzene. Benzol can be produced by this method at a lower cost than by the hydroforming process now used on a smaller scale in the United States to produce benzol from petroleum, according to Dr. Aries, who is president of the New York chemical engineering research organization mentioned above.

New Scientific Society

CREATION of a scientific division of the American Chemical Society, under the title of Div. of High Polymer Chemistry, has been disclosed. The new group, which has elected Professor Carl Shipp Marvel of the University of Illinois as chairman, grew out of the high polymer forums which were held at the Society's semi-annual national meets.

Corrosion-Resistant Pumps

MODIFIED phenolic resins which will resist 60% hydrofluoric acid at elevated temperatures have been developed and produced by Pennsylvania Salt Mfg. Co., Philadelphia 7, Pa. The new material, called Kemplas, is being manufactured and marketed by General Ceramics and Steatite Corp., Keasby, N. J.

To date this phenolic has been used primarily for pumps used in chemical plants. The resins are either cold cast or laminated with glass cloth and molded into desired shapes. In a special problem involving low strength sulfuric acid, no metal or alloy pump had ever been found which could give maintenance-free service for longer than three to four months, according to the company. Six pumps made from Kemplas have been in service on such a job for more than three years with no serious attack. In another case, fittings for plastic pipes for muriatic acid service were lasting only six days. They were replaced by Kemplas fittings which have been in continuous operation for several years.

The company is now preparing to manufacture a full line of equipment including reaction, absorption, and storage vessels, valves, pipings, fittings, pumps, and miscellaneous chemical containers.

Company Growth

AN INTERESTING publication recently released by The Dow Chemical Co. breaks down its annual statement for the fiscal year June 1, 1949 to May 31, 1950, into figures, terms, and illustrations for the benefit of its employees. Among the highlights: Dow's 10,500 customers in 1949 bought $221 million worth of chemicals of which $51 million was for plastics; in 1950, Dow will pay more than $26 million in taxes and $55 million in wages and salaries; the company now employs over 14,500 persons in comparison to 2000 in 1930; in 10 years the firm has grown to almost five times its pre-war size, and the Midland, Mich., concern is now the fourth in size in the United States chemical industry.

Dry Coloring

WITH the current styrene pinch curtailing molders' volume production of finished goods, Herman Gering, president of Gering Products, Inc., Kenilworth, N. J., suggests that a more energetic use of dry coloring methods in molding plants might help to alleviate the situation. He reasons that since volume is down and the molder is forced to run smaller orders, he can conserve inventory by buying crystal and doing his own coloring instead of maintaining a wide variety of colored granules in stock. In this way the molder can run more small orders without having a big molding material inventory.

Gering, one of the leaders in the development of the dry coloring process, made its Drycol process available to molders who wish to do their own own coloring. Gering advises that all Drycol-treated styrene should be molded in molds built for restricted gating with a mixer type nozzle in the press permitting openings of not over ⅛-in., in comparison to the more conventional 5/16-in. opening. Drycol

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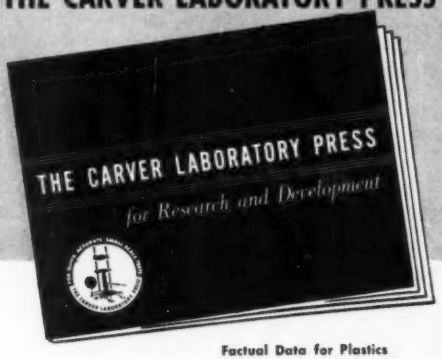

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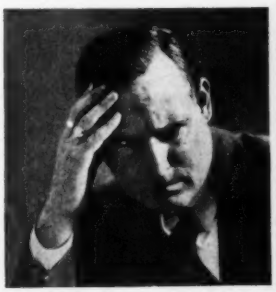

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can be used without either restricted gating or the special nozzle, but brighter, more solid color results if these precautions are taken.

Furfural Plant

CONSTRUCTION of a new chemical plant in Omaha, Neb., for production of furfural has been announced by The Quaker Oats Co. This plant will be similar to the one at Memphis which was purchased for approximately $1,500,000 in 1946. The new plant should be in production by the end of 1951 and will employ about 100 people.

Acrylic for Extrusion

RECENT modifications in Plexiglas VM acrylic molding powder have made it as easy to handle for extrusion as for injection molding, according to the manufacturer, Rohm & Haas Co., Philadelphia, Pa. Physical properties of the powder, a medium heat range material, are unchanged, but the new formulation makes possible extrusions by standard techniques.

Commercial Closures

PLASTICS closures used up 1,660,644 lb. of plastics in July 1950 in comparison to 1,786,126 lb. in the preceding month. The July 1949 figure was 1,240,104 pounds. The cumulative totals from January to July are 11,894,829 lb. for 1950 and 10,559,315 for 1949.

These figures released by the Bureau of the Census cover statistics from 60 companies operating 73 plants; of the 73 plants, 18 produce plastic caps.

Wall Covering

VINYL plastic Naugahyde wall covering for use in hospitals, hotels, restaurants, offices, and homes is now being produced by United States Rubber Co. The wall covering has a tough special backing which gives it stability in hanging and can be applied with conventional adhesives on most wall surfaces. It has a smooth, fine textured grain and is highly resistant to abrasive wear, scuffing, and gouging. It will not become brittle or chip, retains its color and texture, and can be washed with soap and water, according to company claims. The product is made in 30-yd. rolls, 50 in. wide, and comes in 12 colors.

Quilted Vinyl

AN embossed pattern with a three-dimensional appearance suggesting real quilting in unsupported vinyl sheet is being offered by Imperial Chemical & Plastics Corp., Cranston, R. I., as part of its Imperialyte line under the name of Tuftex Junior. Available in 0.012 and 0.020 gage, 54 in. wide, in decorator colors and a wide variety of printed patterns, the material is said to be adaptable for automotive and airplane use, bar furnishings, playrooms, upholstered furniture.

Annual Report Awards

FROM the almost 5000 corporation annual reports for 1949 submitted in the Tenth Annual Survey conducted by *Financial World*, a business weekly, six plastic companies have qualified for "Highest Merit Award" citations to be selected Oct. 30. The six companies are: American Phenolic Corp., Continental-Diamond Fibre Co., The Dobeckmun Co., Drackett Co., Minnesota Mining & Mfg. Co., and National Vulcanized Fibre Co.

Award Winner

ENTERING a clock set in a plastic frame, 16-year old Richard Tobuch won a $100 price in the 1950 Ford Motor Co.'s nationwide Industrial Arts Awards program in which almost 2400 high school students participated. Dick, a senior at Chicago Vocational School and a two-time winner in this competition, also received a $10 honorable mention for a plastic lamp.

Plastic Containers for Medicine

IN June 1949, the Bureau of Medicine and Surgery, Navy Dept., requested the assistance of the National Security Industrial Assoc., 110 Williams St., New York 7, N. Y., in making a study of improved plastics bottles for use in field chests, and also in investigating diffusion through plastics bottles under tropical storage conditions. J. H. Du Bois has accepted the task of organizing a group to assist in these studies. The first report presents in outline the present status of industrial achievement in packaging chemicals in plastics containers. Succeeding sections will give conclusions drawn by the committee from data submitted in response to its survey; will offer recommendations for a specific program designed to develop necessary specialized packing; and will outline the technology of plastics containers.

COMPANY NOTES

Bakelite Div., Union Carbide and Carbon Corp. announces a price increase for Vinylite resins of 2¢ per lb. or from 34 to 36¢ per lb., and the same proportionate increase for Vinylite resin compounds. Polyethylene resins are 4½% higher, advancing from 44 to 46¢ per pound.

Doughboy Industries, Inc., suffered a $500,000 loss when its plant at New Richmond, Wis., was destroyed by fire. The plant manufactured plastic toys.

American Cyanamid Co., Industrial Chemicals Div., announces the availability of a series of acrylic polymers which are water-soluble anionic colloids and are sold as clear aqueous solutions. **The Plastics & Resins Div.** has also announced a price increase of 8¢ per lb. on Melmac 1502 electrical grade melamine molding compound which is currently 50¢ a lb. in lots of standard container or more. Melamine 1500 remains at its former price of 42¢ a pound.

Chemicals Procurement Co., 220 W. 42nd St., New York 18, N. Y., sales agent for specialty and intermediate chemicals, has announced that **Stuart J. Canter** has joined its staff.

The Dow Chemical Co., Midland, Mich., has formed a new **Plastics Basic Research Group** under the supervision of **Robert S. Spencer** to consolidate plastics fabrication laboratory research. New methods of

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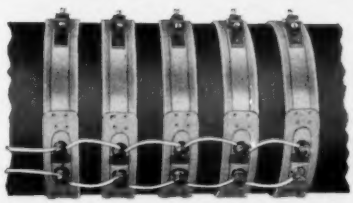

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plastics fabrication will be studied as well as methods now in widespread use. The company has also named **Bennett M. Coons** as plastic molding powder salesman for the Chicago area.

Continental Can Co., New York 17, N. Y., has appointed the following people to its **Plastics Div.**: **Mario J. Petretti** as chief engineer; **Arthur L. Smith** as manager of research and development; and **George P. Lehmann** as general sales manager of the firm.

Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa., manufacturer of electric heating units for industrial, commercial, and domestic uses, has appointed **C. F. Kreiser** as general sales manager and **W. J. Arnold** as industrial sales manager.

Industrial Sales Engineers has been formed by **S. Thomas Held** and **Lou H. Posner** to represent firms doing injection and compression molding, printing on plastics, laminating, and die-cutting. The new firm, which has offices at 17 E. 42nd St., New York, N. Y., will also be the sales agent for Plastallions, compression molded acrylic embedments manufactured by **Creative Plastics Corp.** Mr. Held was formerly sales manager of the **Extruded Plastics Div., Hopp Press** and Mr. Posner was with the **Plastics Specialty Div.** of that firm.

Edwal Laboratories, Inc., Ringwood, Ill., has announced the addition of diallyl amine to its line in pilot plant quantities.

Irvington Varnish & Insulator Co.'s Cap-Seal Div. has opened a Chicago office at 564 W. Monroe St. headed by **Robert M. Alderson.**

National Lead Co., 111 B'way.,New York 6, N. Y., has announced the election of **Graham W. Corddry** as vice president in charge of sales of its subsidiary, **Titanium Pigment Corp. K. W. Ericson** has been named general sales manager, succeeding Mr. Corddry. The firm also announces two new Dutch Boy stabilizers for use in vinyl plastics: CS-137, a sodium-barium material, and Barinac, a barium ricinoleate, both used where exceptional heat and light stability are required.

General Aniline & Film Corp., 230 Park Ave., New York 17, N. Y., has announced that sales of detergents, emulsifiers, and chemical specialties, formerly handled by its **Antara Products Div.**, will be taken over by **General Dyestuff Corp.**

Jefferson Chemical Co., Inc., 711 Fifth Ave., New York 22, N. Y., has announced a new alkyl phenol, C-9, which is a mixture of monoalkyl phenols predominantly para substituted. It is said to possess a relatively high viscosity and is recommended for use as a non-ionic detergent intermediate in the manufacture of lubricating oil additives and in the preparation of various resins and plasticizers.

Lucidol Div., Novadel - Agene Corp., 1740 Military Rd., Buffalo 5, N. Y., has announced the availability of di-t-butyl peroxide in commercial quantities. The stable organic peroxide has a high temperature of decomposition and is claimed to be an excellent source of free radicals. It is suggested for use as a raw material in organic syntheses and as a polymerization catalyst, particularly at temperatures above 100° C.

Bjorksten Research Laboratories, Inc., has purchased a 168-acre tract at Madison, Wis., on which will be constructed buildings for new testing units, scientific equipment, and laboratories.

Victory Mfg. Co. has undertaken an expansion program that includes building improvements and larger molding equipment. The firm now occupies the entire 66,000 sq. ft. in its building at 1722 W. Arcade Place, Chicago 12, Ill.

United States Rubber Co. has made the following appointments in its **Mechanical Goods Div.: Henry A. Rome** is manager of special products sales; **William C. Hall** is manager of molded goods sales; and **Thomas S. Savoury** is manager of flooring sales. Mr. Rome will supervise sales of lathe and wrapped goods, extrusions, Uskon conductive rubber, industrial products, and specialties made of Enrup, the company's new thermosetting plastic. **J. Scott Brown** has been named chief engineer for the **Naugatuck Chemical Division.**

B. F. Goodrich Chemical Co., has purchased **Harmon Color Works, Inc.**, from **American Home Products Co.** Harmon will continue to manufacture organic color pigments and dyes in its two plants at Kearny and Haledon, N. J., under its present management as a subsidiary of Goodrich.

R. S. Aries & Associates has moved its executive offices to 400 Madison Ave., New York 17, N. Y. General engineering offices and drafting rooms will remain at 26 Court St., Brooklyn, N. Y.

Blaw-Knox Co.'s Chemical Plants Div., Pittsburgh, Pa., has named **H. L. Barnebey** manager and **Sanford R. Bell** process engineer for the chlor-alkali department. The division is also constructing additional facilities for the Calumet City, Ill., plant of **Catalin Corp. of America.**

Wizard Boats, Inc., has announced completion of a new 4000-sq. ft. building at Costa Mesa, Calif., which will enable it to double its production of glass fiber boats. The $10,000 installation has three ovens and will be used for additional molding and warehousing of boats and other products.

Southeastern Plastics, Inc., 106 Western Branch Blvd., Portsmouth, Va., has been formed to handle injection molding and engineering product design of thermoplastic and thermosetting materials. Its equipment includes two 8-oz. Reed-Prentice injection machines. The firm is headed by **Robert L. Davis** who was formerly with **Continental Can Co.'s Plastics Division.**

Formica Co. announces that net sales for the three months ending June 3 were $4,727,976 against $3,258,406 in the like 1949 period. Sales in the March quarter were $3,981,257, about 25% ahead of a year ago. Sales for the complete half year were 35% more than in 1949. For the first half year of 1950, earnings were $2.93 compared with $1.98 in

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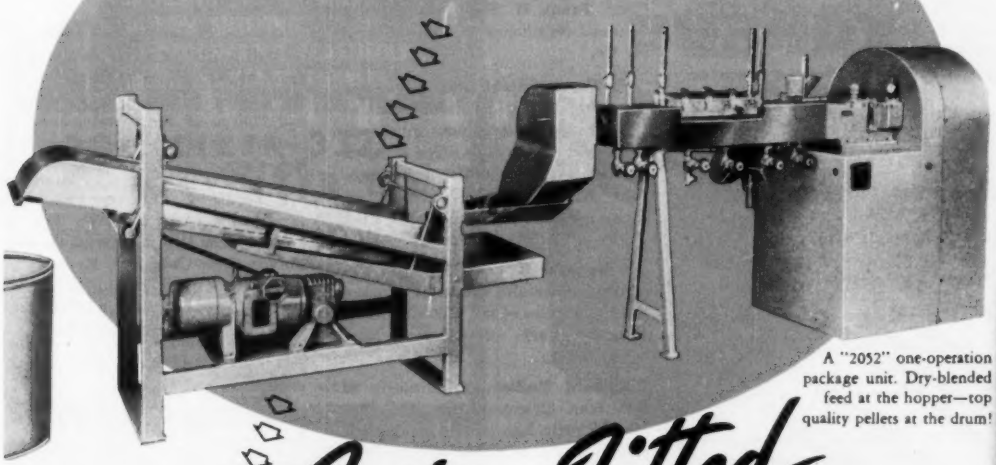

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the initial six months of 1949. The company has broken ground for a new $1 million plant outside of Cincinnati. The new facilities are part of a $7 million over-all expansion program which, when in operation next November, will raise the firm's production by 25 to 30 percent.

Houghton Laboratories, Inc., Olean, N. Y., has purchased a plant consisting of three buildings with 20,000 sq. ft. of floor space from **Susquehanna Chemical Co.,** to be used for the production of the Hysol series of protective coatings.

PERSONAL

Benjamin Sampson has been named general sales manager for **K. H. Huppert Co.,** 6830 Cottage Grove Ave., Chicago 37, Ill., manufacturer of electric laboratory and industrial furnaces and ovens.

Dr. Gustavus J. Esselen, vice president of **United States Testing Co., Inc.,** was recently elected vice president of the **Society of Chemical Industry,** London, England. Dr. Esselen has been chairman of the American section of the society for the past year.

Dr. Franklin T. Peters, formerly with Glyco Products Co., has been named manager of the **Market Development Dept., Heyden Chemical Corp.,** New York 1, N. Y. **Dr. Arthur L. Davis** will be in charge of new products applications.

Dr. E. E. McSweeney has been appointed by **Battelle Memorial Institute** as its representative to the chemical industry to assist prospective sponsors of research in setting up their research programs. He has been with the staff since 1938 and has directed plastics, rubber, and coatings research.

James A. Cooper has been named manager of field sales for Koroseal upholstery materials for the **Plastics Div., The B. F. Goodrich Co.,** Marietta, Ohio.

J. H. DuBois and **Clarence W. Coe** have resigned as officers of Shaw Insulator Co., Irvington, N. J., to assume executive positions with **Hartford-Empire Co.,** of Hartford, Conn. **Frank H. Shaw** has actively resumed presidency of **Shaw Insulator Co.**

S. Thomas Held, formerly sales manager of the Extruded Plastics Div., Hopp Press, is now in charge of the New York sales office of **Apex Plastics, Inc.,** 214-26 41st Ave., Bayside, N. Y., custom extruder of thermoplastics. Mr. Held has opened offices at 17 E. 42nd Street.

William H. Trotter has been appointed to handle the sales promotional activities of the **Chemical Div., Celanese Corp. of America,** New York, N. Y.

Richard Mallamphy, formerly of American Cyanamid Co. and The Mead Corp., has joined **Naugatuck Chemical Co.** as a sales representative for Vibron, Kralastic, and other plastic materials in the Atlantic Coast territory south of Connecticut.

Dr. Herman F. Mark, internationally noted authority on polymer chemistry, who is director of the **Institute of Polymer Research** at **Polytechnic Institute** of Brooklyn, N. Y., has received an honorary degree, Dr. of Engineering, from the University of Liege, Belgium.

Wilbur W. White has been named sales manager for **General Electric Co.'s** Textolite plastics surfacing materials produced by the **Laminated & Insulating Products Div.** of the **Chemical Dept.** at Coshocton, Ohio. Mr. White was formerly with Central Electric Co. and Sears Roebuck & Co.

William D. Caddell has been named general manager of **Anfinsen Plastic Molding, Inc.,** Aurora, Ill.

Dr. Callaway Brown has been appointed research physical chemist at **Armour Research Foundation, Illinois Institute of Technology,** Chicago, Ill. He was previously with Bell Telephone Laboratories and General Electric Co.

A. E. Young has been named assistant manager to **R. H. Boundy** of the **Plastics Div., The Dow Chemical Co.,** Midland, Mich. Mr. Young, a graduate of the University of London, joined Dow in 1937, and has been head of the company's coatings technical service for several years. **Norman R. Peterson,** former assistant to Mr. Young, has been named head of the coatings technical service.

Richard J. Brown has been appointed to the development department of **Russell Mfg. Co.,** Middletown, Conn. Mr. Brown formerly had charge of the development of plastics for textile applications for **Rex Corp.**

R. G. Kress has been appointed sales manager of a newly formed **Polyethylene Div.** of **Extruders, Inc.,** Culver City, Calif. Mr. Kress, who is vice president of the company, will continue his duties as plant and product development manager.

Deceased

George P. Fryling, chairman of the board, **Erie Resistor Corp.,** Erie, Pa., died Aug. 31 at the age of 85. He founded Erie Resistor Corp. in 1928.

MEETINGS

Oct. 31—S.P.I. Canada, Informative Labeling Program, Toronto, Canada.

Nov. 1-3—The American Society of Body Engineers, Fifth Annual Convention, Rackham Memorial Building, Detroit, Mich.

Nov. 6—Thirty-fifth National Hotel Exposition, Grand Central Palace, New York, N. Y.

Nov. 14-15—American Society for Testing Materials, Committee D-20 on Plastics, Cincinnati, Ohio.

Nov. 18—Third annual varnish and paint chemistry symposium sponsored by College of Engineering, New York Paint and Varnish Production Club, and New York Paint, Varnish and Lacquer Association, New York University College of Engineering.

Dec. 3-6—American Institute of Chemical Engineers, Annual Meeting, Neil House and Deshler Wallick Hotel, Columbus, Ohio.

Mar. 13-16—National Association of Corrosion Engineers, 1951 Conference and Exhibition, Hotel Statler, New York, N. Y.

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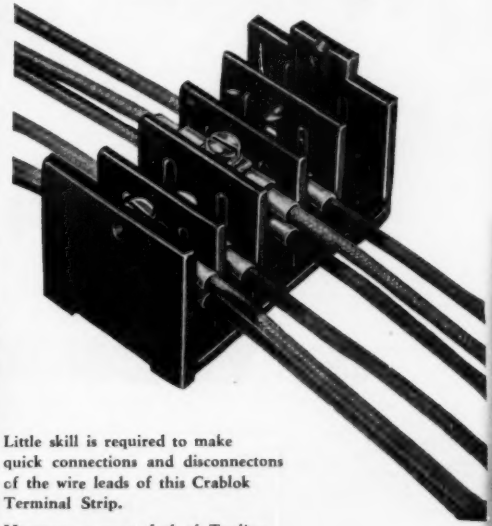

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MODERN PLASTICS reserves the right to accept, reject or censor classified copy.

EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

Machinery and Equipment FOR SALE

FOR SALE: 200 Ton Stokes Press & Pump, 300 Ton D & B Molding Press, 200 Ton W.S. Hobbing Press, 300 Ton W.S. Press 24 x 20 Platen, 175 Ton H.P.M. Press 30 x 30 Platen, 150 Ton Farrel Press 30 x 30" Elec. Plates, 140 Ton W. S. Press 23 x 17" Platens, 85 Ton Stewart Bolling Press, 20 x 20 Platens, 50 Ton Elmes Press with 18 x 18 Elec. Plates, 75 Ton W. S. Press 15 x 15 Platens, 75 Ton Adamson Press 20 x 20 Platens, Model-2P-Thermex Preheater, Model-DE-Airtronics Preheater, Model-CB-Airtronics Preheater, Laboratory Presses, Accumulators, Piston & Oil Pumps. AARON MACHINERY CO., 45 Crosby St., N.Y.C.

FOR SALE: Thermex Preheater, Model 2P; Airtronics Preheater, Model D E; Airtronics Preheater Model C B. Like New. AARON MACHINERY CO., INC., 45 Crosby St., New York 12, N. Y. WOrth 4-8233.

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HYDRAULIC PRESSES REBUILT TO SPECIFICATIONS for plastic items, industrial purposes and phonograph record presses. We have in the used equipment (1) Baldwin-Southwark 8" x 8" stroke, 2500# W. P. weighted accumulator $2000, (1) 400 tons, 32 x 45, 18" ram, 36" stroke, 12' daylight $2200. (3) 300 ton 26 x 26, 12" ram, 24" stroke @ $2500 ea. (1) 400 ton 22 x 30, 16" ram, 18" stroke, 36" day-light $1500, (2) 150 ton 42 x 46, 12" ram, 36" stroke, 40" daylight $900 each, (6) 250 ton 32 x 66, 12" double ram, 48" daylight, 12" stroke, flange type packing $1850 ea. HYDRAULIC SALPRESS INC., 386-390 WARREN STREET, BROOKLYN 2, N. Y.

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FOR SALE: Ball & Jewell No. 1 Cutter & Double Arm Jacketed Mixers, 25 gal., 100 gal., 250 gal., 250 gal. Stainless. PERRY EQUIPMENT CORP., 1529 W. Thompson St., Phila. 21, Pa.

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FOR SALE: Two Hydraulic Cylinders for 8 oz. Lester Injection Molding Machines. Model No. L 2½-8. Slightly used. Complete with Injection Cylinder, Feed Cup, and Tie Rods. Reasonable. Make offer. Reply Box 723, Modern Plastics.

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Loewy 2500 PSI, 270 gal. '44	8500.
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Farrel Reducer 500 HP, new '43, 5 to 1	2500.
3/Dimes. Keller Duplicator, Model E-4	3950

EVEREADY CO. E. J. McCallum, Prop. 805 Housatonic Ave. 4-9471, Bpt. Conn.

INJECTION MOLDING MACHINE: 1—4 oz. Reed Prentice, Model 10-A, in good working condition. Priced advantageously. Can be inspected in my New York warehouse. ALFRED A. ROSENTHAL, 3 Park Row, N. Y. 7, REctor 2-2747.

FOR SALE: Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars address Box 734, Modern Plastics.

Machinery and Equipment WANTED

WANTED: 20 or 24 ounce Injection Molding Machine. Give full particulars. Reply Box 724, Modern Plastics.

WANTED: One 150 ton Stokes semi-automatic compression moulding press, complete with time controls. Must be in good condition and subject to examination. Reply Box 726, Modern Plastics.

WANTED: Hydraulic Steam Platen Press. Minimum three openings—58" x 110"—500 psi on work—with equipment—submit full particulars, make of Press, former use, etc. Reply Box 730, Modern Plastics.

WANTED: #200 D-3 Stokes 15 Ton Automatic Molding Press. Also hydraulic cylinders 3" Bore, 4" Stroke. Reply Box 731, Modern Plastics.

Materials Wanted

WANTED: PLASTIC Scrap or Rejects in any form. Acetate Butyrate, Polystyrene, Acrylic, Vinyl Polyethylene, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding, magnetizing and compounding. Reply Box 712, Modern Plastics.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic and Ethyl Cellulose. Reply Box 713, Modern Plastics.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. Franklin Jeffrey Corporation, 1671 McDonald Avenue, Brooklyn, N. Y. ES 5-7943.

SURPLUS UREA MOLDING POWDER WANTED. Reply Box 714, Modern Plastics.

WANTED: Surplus inventories of Virgin Injection Molding Compounds in any quantities from 1000 pounds up. Will pay premium prices where prevailing. Musi-Waltzer and Company, 60 East 42 Street, New York City 17, New York.

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POLYSTYRENE or ACETATE in virgin or scrap. Any quantities. Reply Box 727, Modern Plastics.

WANTED: Titanium Dioxide Pigments (any grade) needed to carry on our business. Not interested in any 85¢ or 95¢ Black Market deals. Would appreciate a few bags from manufacturing concerns who can possibly spare some. Will pay any reasonable premium or exchange for other critical chemicals. Samuel Smidt Chemical Co., 410 Frelinghuysen Ave., Newark, N. J.

WANTED: Surplus quantities of virgin or reground polystyrene. Reply Box 733, Modern Plastics.

Materials For Sale

FOR SALE: 8,250 lbs. Durez #11863, Flow 8, Mica Filled Natural Thermosetting Molding Powder at 15¢ per lb., FOB Philadelphia, Pa. Pyramid Chemical Company, Liberty Trust Bldg., Broad & Arch Streets, Philadelphia 7, Pa.

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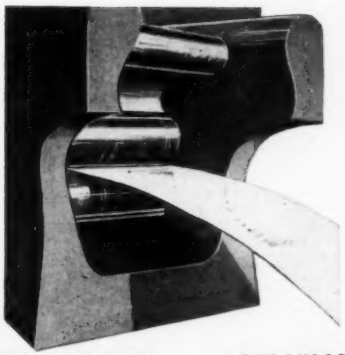

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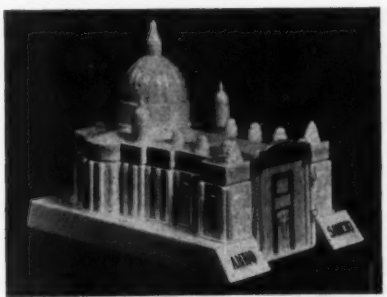

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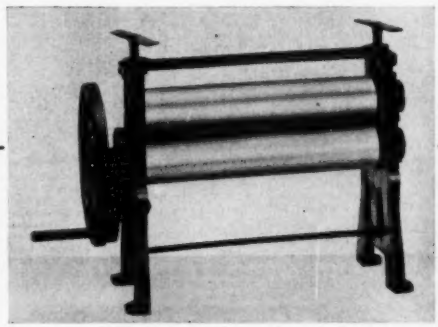

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CAnal 6-3010

CLASSIFIED ADVERTISING

(Continued from page 200)

FOR SALE: 200 Tons of Resin Impregnated Paper Broke. 200 Tons of Vinyl Cable Strippings. 20 Tons of Black and Brown Vinyl Film. 40 Tons of Mineral Rubber, 9 Tons of Calcene. Reply Box 739, Modern Plastics.

WANTED: Your Scrap Vinyl, Polyethylene, Polystyrene, Acetate, Ethyl Cellulose, and etc.
OFFERING: Reprocessed Granulated Plastic, Custom Grinding, and Straining. Reply Industrial Plastic & Textile Company, 72 Woolsey Street, Irvington, N. J.

HELP Wanted

WANTED: Sales representatives wanted in key cities for fast-selling, strongly advertised line of welded plastic specialties—wallets, etc. Exceptional opportunity for those having retail contacts. Territories protected. No objection to handling other unrelated products. Outline experience and territory desired to Box 720, Modern Plastics.

CHEMIST WANTED: Experienced in coating organosol film. Good opportunity with large aggressive firm. Our employees know of this ad. Box 722, Modern Plastics.

MOLDING DEPARTMENT SUPERVISOR: Excellent opportunity in well established company in northern New Jersey. Up-to-date plant, modern injection molding equipment. At least five years' experience preferred. Give full qualifications. Reply Box 725, Modern Plastics.

SALES ENGINEER — Injection Molding, with some experience, for long established custom molder in New York metropolitan area. Excellent opportunity for able and aggressive young man. Reply giving age, education, previous employment, salary to Box 732, Modern Plastics.

PLASTICS CHEMIST: Must be experienced in formulating vinyl resins, hot melts and plastisols. Take full charge of lab in large Pacific Coast Organization. State age, experience, and qualifications in first letter. Reply Box 735, Modern Plastics.

WANTED: Sales Representative for Injection Molding Concern for Metropolitan New York, New York State and New England. Knowledge of injection molding desirable but not essential. Must have good business contacts. Reply Box 738, Modern Plastics.

WANTED for injection molding plant in the New England area: Engineer with mold manufacture and general thermoplastic production experience. State full particulars. Reply Box 741, Modern Plastics.

WANTED:—Assistant Molding Supervisor for large injection molding plant located in the New England area. State experience, age, education. Reply Box 742, Modern Plastics.

WANTED: Superintendent, Southern California plastic extrusion plant.
MUST: Have experience and best of references. Be able to do, and direct, precision work. Know die design, modern compounds and methods. Be able to get along with people. Direct production control, record and evaluate costs. A real opportunity for the right man to develop with a growing company. Reply Box 743, Modern Plastics.

Situations Wanted

LAMINATION, EXTRUSION, COATING. Production and development. Experienced as technical director in both electrical and chemical fields. Textiles, papers, films and flexible metals industrial and defense packaging materials and products including pipe and thin polyethylene film. Inorganic and organic resins and rubbers. Can be available for two days per week on permanent basis. Reply Box 716, Modern Plastics.

PRODUCTION SUPERVISOR of sheet forming and precision fabricating of thermoplastics ie., Plexiglas, Lucite, Acetate and Royalite, desires position with established firm. Engineering background includes thorough knowledge of complex forming, mold design, shop methods, estimating, production control and plant layout. Excellent references. Reply Box 717, Modern Plastics.

RESEARCH EXECUTIVE. Ph.D. with extensive background in formulating vinyl compounds for calendering and extrusion. Considerable experience in both Plant Operation and Sales. Seeks position as Research Manager or equivalent with a progressive organization. Full details upon request. Reply Box 718, Modern Plastics.

SALES MANAGER: Executive, wishes to make change after nine years. College graduate, 35, married. Experienced in the creation and supervision of a National sales organization. Have mature business judgment and capable of relieving top management of details. Prolific on promotion ideas, new product design and packaging. Have a good basic knowledge of plastics. Will relocate. Reply Box 728, Modern Plastics.

MANUFACTURER OR MOLDER: Small to medium, engaged in or contemplating use of reinforced plastics or resin bonded wood waster. My knowhow, ingenuity and unconventional methods may be just what you need. Background of supervision, plant layout, methods development, trouble shooting with pioneers and leaders in their fields. Responsible to top management only. Married, age 29, will relocate. Reply Box 736, Modern Plastics.

Miscellaneous

WANTED: Small Flat Plastic Boxes 5 to 50,000 small flat, square or round plastic boxes; any color, even transparent—to house a metal coin 1⅝ x 12 gu; cover may be hinged, screw cap or snap down type. A small flat pill box might do. Please submit samples with prices to H. R. Bauer, c/o Post Office, Fairfield, Conn.

PLASTIC MOLDING—COMPLETE JOBBING-PLANT: Capacity 75 to 365 tons; eleven compression hydraulic presses; employ up to 45; modern brick building, 51x205; Railroad siding; fully equipped for all type plastics; established same owner fifteen years; sell complete with property to settle estate; present personnel may be retained; price reasonable; for information: THE APPLE COMPANY, 1836 Euclid, BROKERS, CLEVELAND, OHIO.

AVAILABLE FIELD SERVICE: Rolls reground, restored to original finish, shape or crowns altered. Rust removed, indentations or holes satisfactorily refilled, insuring a smooth surface. Any roll problem, open for consultation. Unnecessary to remove rolls from frames, work done without interruption to production. Fully insured in all localities. Reply Box 715, Modern Plastics.

WANTED: Used roll leaf stamping press, manual or pneumatic, also fonts of steel type. State make, model, size, price etc. Have open time on 2 ounce injection molding press, fast cycle, long or short runs, and for experimental and development work. Also interested in purchasing molds for 2 ounce press. Box 1, Bergen Station, Jersey City 4, N. J.

PLASTIC INJECTION MOLDING FACTORY WANTED: 25,000 feet or more, 1 or 2 floors, railroad siding preferable. Reasonable sales price. Will pay cash. Reply Box 740, Modern Plastics.

We require information on all phases of the process of Urea spraying to produce mottled buttons. We are prepared to pay well for this information. Reply Box 729, Modern Plastics.

FOR SALE: Manufacturing plant, 32,000 sq. ft. and approximately 2 acres. All brick walls, slate roof, wood and concrete floors, steam heated. Concrete loading dock on NYC, R.R. Suitable for many types of manufacturing. Excellent terms. B. F. Pence, Box 306, New Castle, Ind.

Patent now pending on useful plastic article for the kitchen and dining room. Should retail for thirty cents. Since there has always been a demand for an item of this nature the sales possibilities should be enormous. Will require large manufacturing plant to handle. Article available on royalty basis. Address Guy M. Hamilton, 1654 North Decatur Road N. E., Atlanta, Ga.

CONTRACT WORK WANTED: Completely equipped with workers and storage areas to handle large and small orders for assembling, wrapping, and packaging all sorts of products. You will save money for we are a non-profit institution. Address Mr. Harold Weitz, N. Y. Guild for Jewish Blind, 1880 Broadway, New York 23, N. Y.

FOR SALE: Dress snap fasteners moulded in P.V.C., resilient, everlasting, washable, rustless and a wide range of colours which neither fade or chip. We offer 6—36 cavity injection moulds for production of three sizes of fastener, also all patent rights. Universal Tools Ltd., Tramway Path, Mitcham, Surrey, England.

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Send for our bulletin on your company letterhead.

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TELEPHONES: MARKET 3-1572-73

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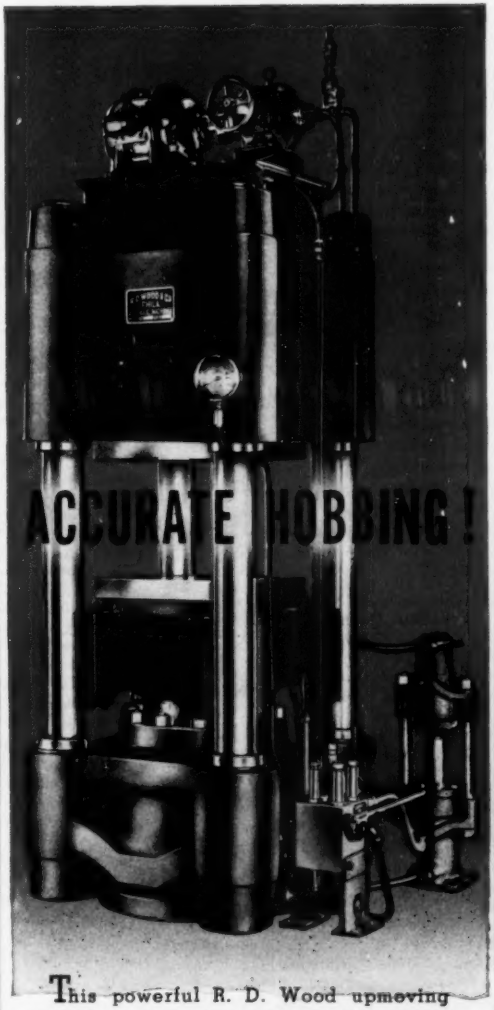

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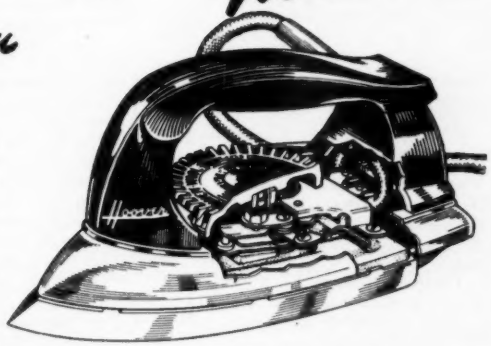

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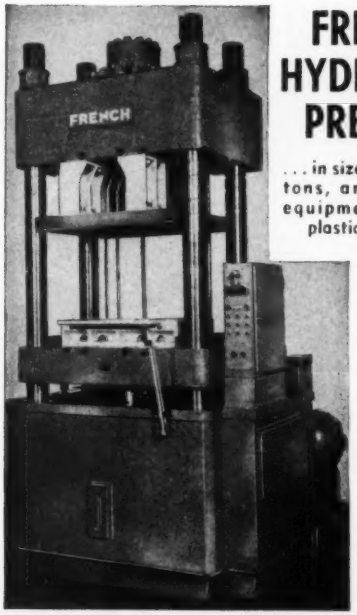

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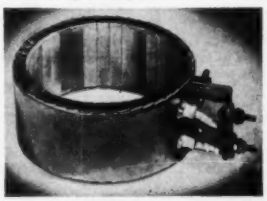

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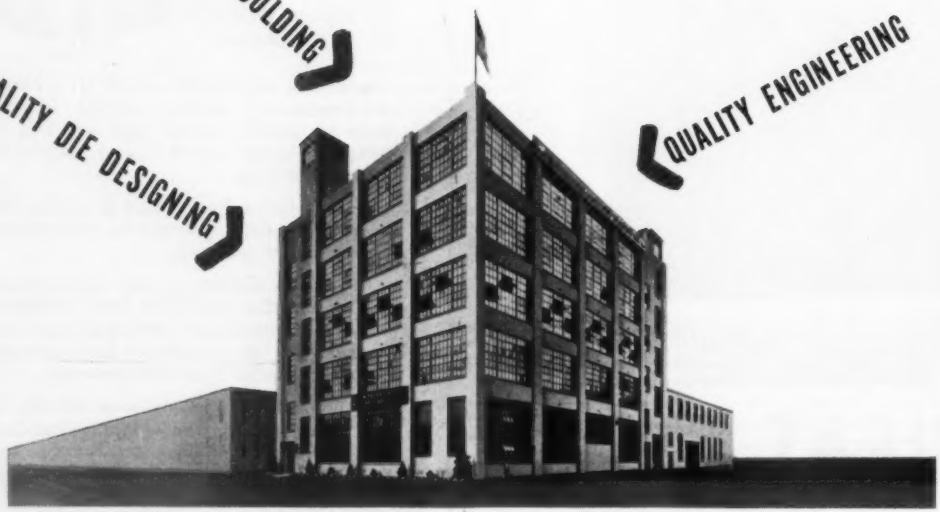

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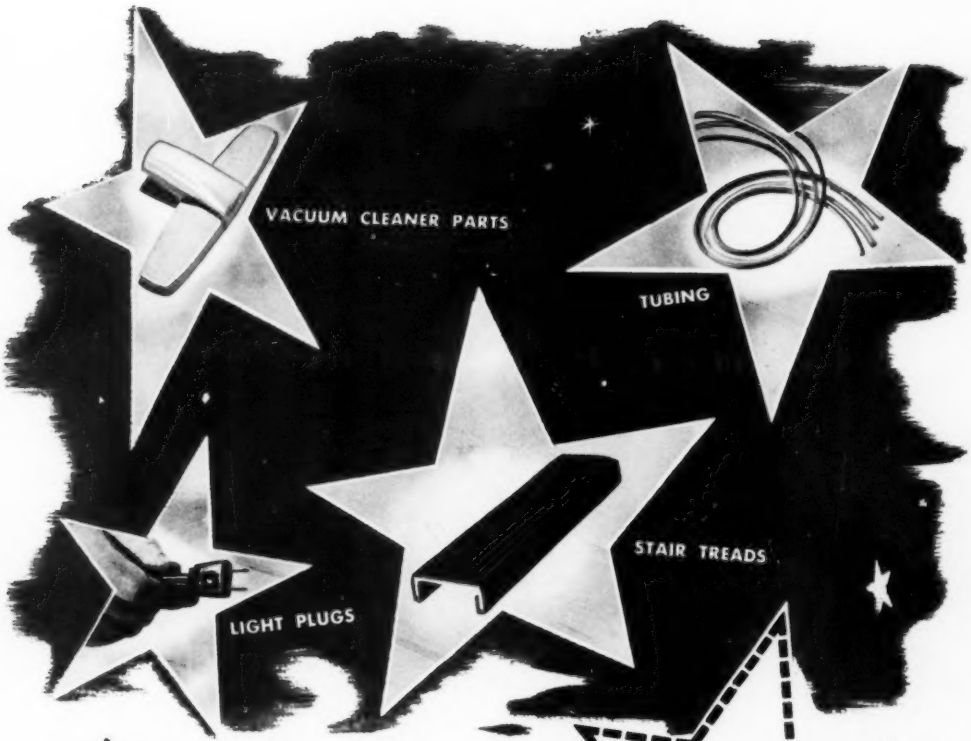

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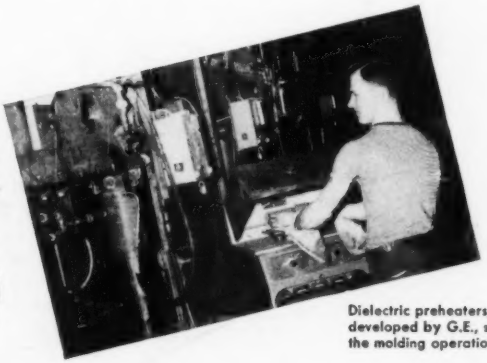

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